HEWLETT PACKARD

OPERATING AND SERVICE MANUAL

MODEL 4262A
LCR METER

(including Options 001, 004, 010, and 101)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prafixed 2514J

With changas described in Section Ⅶ, this manual also applies to instruments with serial numbers prefixed 1710J, 1739J, and 2022J

For additional important information about serial numbers, see INSTRUMENTS COVERED BY MANUAL in Section I.

Manual Part No. 04262-90007
Microfiche Part No. 04262-90057

Printed : JUN. 1987

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and the mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING

Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

Herstellerbescheinigung

Hiermit wird bescheinigt, daß das Gerät HP 4262A digital LCR meter in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Anm: Werden Meß- und Testgeräte mit ungeschirmten Kabeln und/oder in offenen Meßaufbauten verwendet, so ist vom Betreiber sicherzustellen, daß die Funk-Entstörbestimmungen unter Betriebsbedingungen an seiner Grundstücksgrenze eingehalten werden.

GERÄUSCHEMISSION

Lpa < 70 dB
am Arbeitsplatz
normaler Betrieb
nach DIN 45635 T. 19

Manufacturer's Declaration

This is to certify that this product, the HP 4262A digital LCR meter, meets the radio frequency interference requirements of directive 1046/84. The German Bundespost has been notified that this equipment was put into circulation and was granted the right to check the product type for compliance with these requirements.

Note: If test and measurement equipment is operated with unshielded cables and/or used for measurements on open set-ups, the user must insure that under these operating conditions, the radio frequency interference limits are met at the border of his premises.

ACOUSTIC NOISE EMISSION

Lpa < 70 dB
operator position
normal operation
per ISO 7779

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LIST OF ILLUSTRATIONS

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

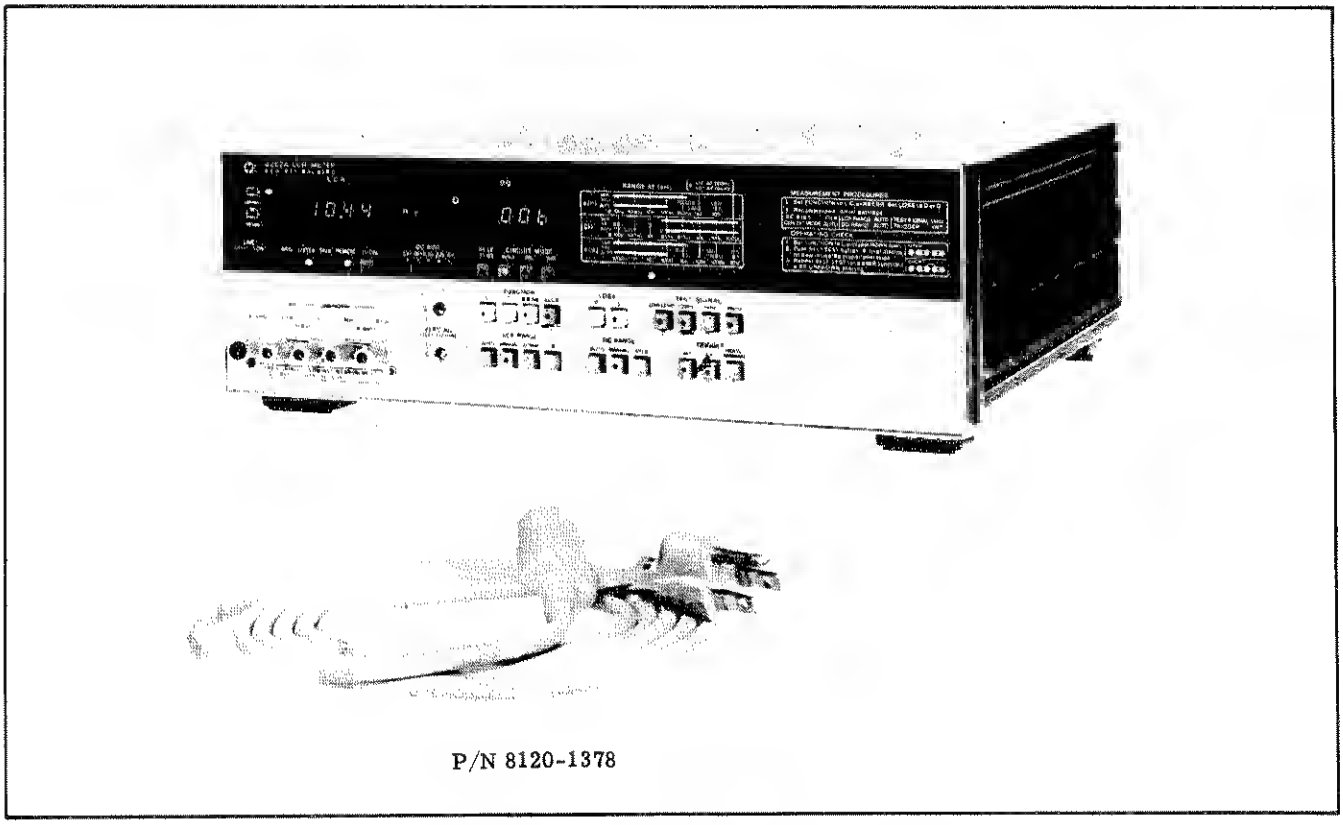
1-2. This operating and service manual contains the information required to install, operate, test, adjust and service the Hewlett-Packard Model 4262A Digital LCR Meter. Figure 1-1 shows the instrument and supplied accessories. This section covers specifications, instrument identification, description, options, accessories, and other basic information.

1-3. Listed on the title page of this manual is a microfiche part number. This number can be used to order 4 x 6 inch microfilm transparencies of the manual. Each microfiche contains up to 60 photoduplicates of the manual pages. The microfiche package also includes the latest manual changes supplement as well as all pertinent service notes. To order an additional manual, use the part number listed on the title page of this manual.

1-4. DESCRIPTION.

1-5. The HP Model 4262A LCR Meter is a general purpose, fully automatic test instrument designed to measure the parameters of an impedance element with high accuracy and speed. The 4262A measures capacitance, inductance, resistance (equivalent series resistance) and dissipation factor or quality factor over a wide range at test frequencies of 120Hz, 1kHz and 10kHz employing a five-terminal connection configuration between the component and the instrument. The measuring circuit for the device to be measured is capable of both parallel and series equivalent circuit measurements and the measured values are displayed by the two three-full digits LED displays on the front panel. A convenient diagnostic function, also featured in the 4262A, is actuated by a SELF TEST switch. This confirms functional operation of the instrument.

1-6. The measuring range for capacitance is from 0.01pF to 19.99mF, inductance from 0.01μH to 1999H, and resistance from 1mΩ to 19.99MΩ, which are measured with a basic accuracy of 0.2 to 0.3% depending on test signal level, frequency, and measuring equivalent circuit, and at typical measuring speeds of 220 to 260 milliseconds at



P/N 8120-1378

Figure 1-1. Model 4262A and Accessories.

Table 1-1. Specifications (Sheet 1 of 4).

COMMON SPECIFICATIONS

Parameters Measured: C - D or Q (1/D)
L - D or Q (1/D)
R (ESR) (Loss measurement can be negated by switch on internal board).

Display: 3-1/2 Digit, Maximum Display 1999 (When D value is more than 10, maximum display is 199).

Measurement Circuit Modes:
Auto, Parallel, and Series

Measurement Terminals: 5-terminal configuration (high and low terminals for both potential and current leads plus guard).

Range Modes: LCR - Auto and Manual (up-down)
DQ - Auto and Manual (step)

Measurement Frequencies: 120(100)Hz, 1kHz and 10kHz ±3%.

Test Signal Level: Normal level: 1Vrms.
Low level : 50mVrms (parallel capacitance mode only)

Warm-up Time: 15 minutes

Deviation Measurement: When △LCR key is depressed, the existing measured value is stored as a reference value and displayed value is offset to zero. The range is held and deviation is displayed as the difference between the referenced value and subsequent result. (Deviation spread in counts from -999 to 1999).

Offset Adjustment: Stray capacitance and residual inductance of test jig can be compensated for as follows:

C: up to 10pF
L: up to 1μH

Self Test: Annunciates either Pass, or Fail for performance in each of the five basic ranges.

DC Bias:
Internal: 1.5V, 2.2V, 6V (Selectable at front panel). Accuracy ±5%
External: External DC bias connector on rear panel. Maximum +40V.

Trigger: Internal, External, or Manual

GENERAL

Operating Temperature & Humidity:
0°C to 55°C at 95% RH(to 40°C)

Power Requirements: 100/120/220V ±10%, 240V +5% -10% 48 - 66Hz

Power Consumption: 55VA with any option

Dimensions: 426(W) x 147(H) x 345(D)mm (16-3/4" x 5-3/4" x 13-3/4")

Weight: Approximately 8kg (Std)

Table 1-1. Specifications (Sheet 2 of 4).

C-D, C-Q MEASUREMENT

Ranges	C	120Hz	1000pF	10.00nF	100.0nF	1000nF	10.00μF	100.0μF	1000μF	10.00mF
		1kHz	100.0pF	1000pF	10.00nF	100.0nF	1000nF	10.00μF	100.0μF	1000μF
		10kHz	10.00pF	100.0pF	1000pF	10.00nF	100.0nF	1000nF	10.00μF	100.0μF
	D		.001～19.9 (2 Ranges)							
	Q *1		0.05～1000 (4 Ranges)							
Test Signal Level *2			1V or 50mV (LOW LEVEL)							
							10μA	100μA	1mA	10mA	40mA
	AUTO		Same as Mode				Same as Mode			
C Accuracy *3			0.2% + 1 counts (Test signal level; 1V)							
			0.5% + 3 counts	0.3% + 2 counts (Test signal level; 50mV)						
		(At 120Hz, 1kHz)	0.3% + 2 counts				0.5% + 2 counts	1% + 2 counts *4		
		(At 10kHz)	0.3% + 2 counts				1% + 2	5% + 2		
	AUTO		Same as Mode				Same as Mode			
D(1/Q) Accuracy *3			0.2% + (2 + 200/Cx) counts (At 120Hz, 1kHz (Test signal level; 1V) At 10kHz)							
			0.5% + (2 + 200/Cx) counts							
			0.3% + (2 + 1000/Cx) counts (At 120Hz, 1kHz (Test signal level; 50mV) At 10kHz)							
			1.0% + (2 + 1000/Cx) counts							
		(At 120Hz, 1kHz)	0.3% + (2 + Cx/500) counts					1% + (5 + Cx/500)		
		(At 10kHz)	0.5% + (2 + Cx/500) counts				1% + (5 + Cx/500)	5% + (5 + Cx/500)		
	AUTO		Same as Mode				Same as Mode			

*1 Calculated from D value as a reciprocal number.
*2 Typical data, varies with value of D and number of counts.
*3 ±(% of reading + counts). Cx is capacitance readout in counts. This accuracy only applies for D values to 1.999. (For higher D values, refer to General Information).
*4 (5% + 2 counts) at 1kHz.

Accuracy applies over a temperature range of 23°C ± 5°C (At 0°C to 55°C, error doubles).

Note: C accuracy for higher D values are unspecified.

Table 1-1. Specifications (Sheet 3 of 4).

L-D, L-Q MEASUREMENT

Ranges	L 120Hz	1000μH	10.00mH	100.0mH	1000mH	10.00H	100.0H	1000H
	L 1kHz	100.0μH	1000μH	10.00mH	100.0mH	1000mH	10.00H	100.0H
	L 10kHz	10.00μH	100.0μH	1000μH	10.00mH	100.0mH	1000mH	10.00H
	D	.001～19.9 (2 Ranges)						
	Q*1	0.05～1000 (4 Ranges)						
Test Signal Level *2		1V						
		40mA	10mA	1mA	100μA	10μA		
	AUTO	Same as Mode			Same as Mode			
L Accuracy*3		(At 120Hz, 1kHz)			0.3% + 2 counts		1% + 2 counts	
		(At 10kHz)			0.3% + 2 counts		1% + 2	5% + 2
		0.2% + 2 counts					(At 120Hz, 1kHz)	
		0.3% + 2	0.2% + 2 counts				(At 10kHz)	
	AUTO	Same as Mode			Same as Mode			
D(1/Q) Accuracy		(At 120Hz, 1kHz)			0.3% + (3 + Lx/500)		1% + (3 + Lx/500)	
		(At 10kHz)			0.5% + (3 + Lx/500)		$1\% \cdot (3 + \frac{Lx}{500})$	$5\% \cdot (5 + \frac{Lx}{500})$
		0.2% + (3 + 200/Lx) counts					(At 120Hz, 1kHz)	
		0.5% + (3 + 200/Lx) counts					(At 1kHz)	
	AUTO	Same as Mode			Same as Mode			

*1 Calculated from D value as a reciprocal number.
*2 Typical data, varies with value of D and number of counts.
*3 ±(% of reading + counts). Lx is inductance readout in counts. This accuracy only applies for D values to 1.999.

Accuracy applies over a temperature range of 23°C ± 5°C. (At 0°C to 55°C, error doubles).

R/ESR MEASUREMENT

Ranges	120Hz R/ESR 1kHz 10kHz	1000mΩ	10.00Ω	100.0Ω	1000Ω	10.00kΩ	100.0kΩ	1000kΩ	10.00MΩ
Test Signal Level *1		1V							
		40mA	10mA	1mA	100μA	10μA			
	AUTO	Same as Mode			Same as Mode				
Accuracy *2		0.3% + 2 counts *3							
		0.2% + 2 counts							
	AUTO	Same as Mode			Same as Mode				

*1 Typical data, varies with number of counts.
*2 ±(% of reading + counts).
*3 (0.5% + 2 counts) on 10.00MΩ range at 10kHz.
** Measurement range for ESR (equivalent series resistance) is from 1mΩ to 19.99kΩ (typical), which varies with series capacitance and inductance value . . . . refer to "REFERENCE DATA".

Accuracy applies over a temperature range of 23°C ± 5°C. (At 0°C to 55°C, error doubles.)

Table 1-1. Specifications (Sheet 4 of 4).

OPTIONS

Option 001: Simultaneous BCD output of LCR and DQ data (positive true). Max. sink current 16mA. Mating connector (P/N 1251-0086). (Alternate BCD output of LCR and DQ data selectable by switch on internal board).

Option 004: Digital comparator (can not be used with OPT 101). Compares measured value with high and low limit settings for LCR or DQ and provides HIGH, IN, LOW comparison outputs.

Limit setting range: 0000 - 1999 for each limit switch.
Comparison output: Visual, relay contact, and TTL level.
Visual: 3 LED's indicate HIGH(red), IN (green), or LOW (red).
Relay contacts:
SPST contacts to circuit common for each HIGH, IN and LOW output.
TTL level:
Open collector circuits to high level (open) for each HIGH, IN and LOW outputs (fanout max. 30mA).

Option 101: HP-IB data output & remote control.

Remotely controllable functions:
Function (L, C, R/ESR, △LCR)
Loss (D, Q)
LCR range
DQ range
Circuit mode
Test frequency & level
Trigger
Self test
Data output: C - D/Q, L - D/Q, R/ESR
Internal function allowable subsets:
SH1, AH1, T5, L4, RL1, DC1, SR1 and DT1.
Data output format: Either of two formats may be selected. Switchable at rear panel (no + sign outputs).
Format A.

SFFT±N.NNNE+NN, SF±N.NN(CR)(LF)

Format B.

SFFT±N.NNNE±NN(CR)(LF)

SF±N.NN(CR)(LF)

SFFT
- Test Frequency
- Measurement Equivalent Circuit
- Measurement Status

SF
- Loss measurement D or Q
- Measurement status

Option 010: 100Hz test frequency instead of 120Hz.

ACCESSORIES AVAILABLE

16061A: Test fixture, direct coupled, 5-terminal Two kinds of inserts are included for components with either axial or radial leads. Usable on all ranges of 4262A.

16062A: Test cable with alligator clips, 4-terminal. Useable for low impedance measurements. Measurement range at 1kHz is $L \leq 2H$, $C \geq 200nF$ and $R \leq 10k\Omega$. [For L and C measurements, these ranges increase by x10 at 120 (100)Hz and decrease by same factor at 10kHz].

16063A: Test cable with alligator clips, 3-terminal. Useable for high impedance measurements. Measurement range at 1kHz is $L \geq 3mH$, $C \leq 10\mu F$ and $R \geq 200\Omega$. [For L and C measurement, these ranges increase by x10 at 120(100)Hz and decrease by same factor at 10kHz].

Table 1-2. General Information.

Measurement Times (typical):

For a 1000 count measurement on a low loss component on a fixed range:

Test Frequency	Function	Meas. Time
1kHz, 10kHz	C/L	220-260ms
	R	120-160ms
120(100)Hz	C/L	900ms
	R	700mS

When autorange is selected the following times per range step must be added to the above times:

1kHz, 10kHz	45ms/180ms
120(100)Hz	150ms/670ms

When U-CL is displayed, the faster ranging time is selected.

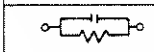
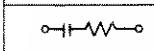
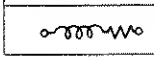
Reading Rate:

Internal - Approx. 30ms between end of measurement and start of next cycle.

External - Measurement cycle is initiated by external trigger input.

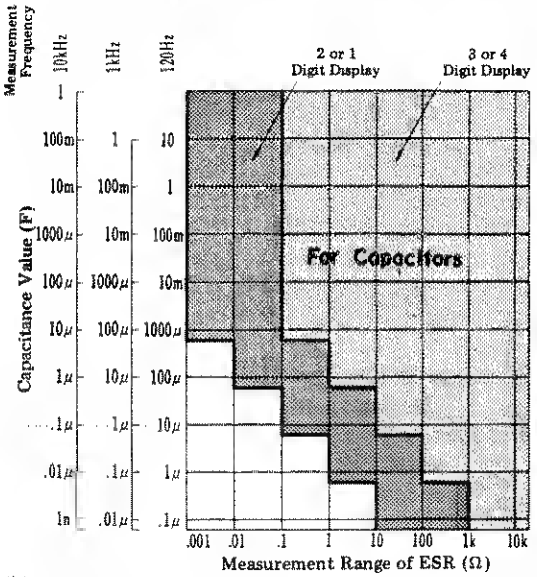
High D Factor Accuracies:

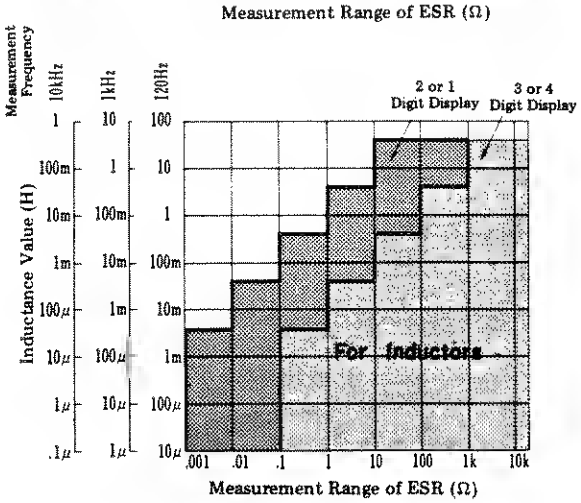
Typical
(≥ 2, on 10.00 range).

Circuit Mode	Accuracy
	5 % + (2 + 1000/Cx)
	5 % + (5 + Cx/500)
	5 % + (5 + Lx/500)
	5 % + (3 + 200/Lx)

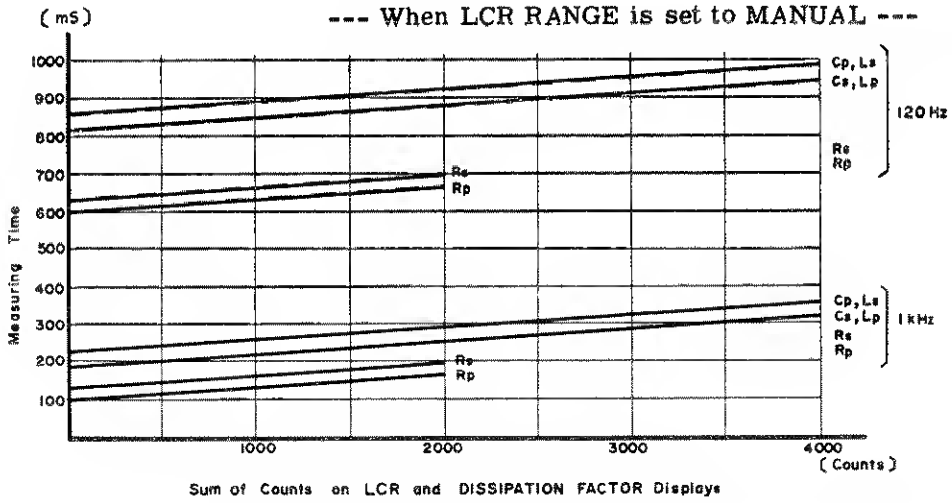
ESR (Equivalent Series Resistance) Measurement:

Following tables show ESR measurement range for capacitors and inductors.





MEASURING TIME



1kHz and 10kHz and about 900 milliseconds at 120Hz. The wide range capability of the 4262A enables a measurement range from small capacitances such as mica capacitors and the parasitic capacitance of a semiconductor device through high capacitances such as the measurement of electrolytic capacitors to be covered. A wide range of inductance measurements from the inductance of a high frequency transformer to that of a power transformer can be measured. The wide resistance range permits the measurement of wirewound resistors through the measurement of solid resistors. In parallel capacitance measurements, either a test signal level of 1Vrms, or 50mVrms can be selected.

1-7. The 4262A bas the capability of making capacitance, inductance, and resistance deviation measurements. This function is enabled by pushing the Δ LCR switch to display the deviation of a reference value. When the Δ LCR switch is depressed the reference value is obtained and memorized from the preceding measurement. The practical use of this feature is evident when it is desired to make a measurement on a variable capacitor: First, the minimum value is measured, then the Δ LCR button is pushed. Minimum to maximum capacitance is now displayed as the capacitor is rotated through its range. For parallel capacitance measurements, test signal levels of either 1Vrms or 50mVrms may be selected. Other versatile 4262A capabilities and features are, for example, the use of internal and external dc bias voltages, LC zero adjustment, and options providing BCD output, HP-IB interfacing capability, or a comparator function.

1-8. SPECIFICATIONS.

1-9. Complete specifications of the Model 4262A LCR Meter are given in Table 1-1. These specifications are the performance standards or limits against which tbe instrument is tested. The test procedures for the specifications are covered in Section IV Performance Tests. Table 1-2 lists general information. General information is not specifications but is typical characteristics included as additional information for the operator. When the 4262A LCR Meter is shipped from the factory, it meets the specifications listed in Table 1-1.

Figure 1-2. Serial Number Plate.

1-10. SAFETY CONSIDERATIONS.

1-11. The Model 4262A LCR Meter has been designed to conform to the safety requirements of an IEC (International Electromechanical Committee) Safety Class I instrument and is shipped from the factory in a safe condition.

1-12. This operating and service manual contains information, cautions, and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

1-13. INSTRUMENTS COVERED BY MANUAL.

1-14. Hewlett-Packard uses a two-section nine character serial number which is marked on the serial number plate (Figure 1-2) attached to the instrument rear panel. The first four digits and the letter are the serial prefix and the last five digits are the suffix. The letter placed between the two sections identifies country where instrument was manufactured. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-15. An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this new instrument may be accompanied by a yellow Manual Changes supplement or have a different manual part number. This supplement contains "change information" that explains how to adapt the manual to the newer instrument.

1-16. In addition to change information, the supplement may contain information for correcting errors (called Errata) in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with this manual's print date and part number, both of which appear on the manual's title page. Complimentary copies of the supplement are available from Hewlett-Packard. If the serial prefix or number of an instrument is lower than that on title page of this manual, see Section VII Manual Changes.

1-17. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-18. OPTIONS.

1-19. Options for the Model 4262A LCR Meter are available for adding the following capabilities:

Option 001: BCD Parallel Data Output.
Option 004: Comparator. A comparator function providing GO/NO-GO judgement with HIGH and LOW limits for LCR and D/Q.
Option 101: HP-IB Interface.
Option 010: 100Hz Test Frequency. (instead of 120Hz)
Options 907, 908 or 909 are handle or rack mount kits. See paragraph 1-29 for details.
Option 910: Extra Manual.

1-20. OPTION 001.

1-21. The 4262A option 001 provides separate BCD parallel data output for L, C, R/ESR and dissipation factor or quality factor simultaneously from the two rear panel connectors. With this option, external data processing devices such as a digital printer can be used with the 4262A.

1-22. OPTION 004.

1-23. The 4262A Option 004 provides for GO/NO-GO judgement by comparing L, C, R/ESR and D/Q values to HIGH and LOW limits. Three judgement outputs are provided: LED lamp display, relay contacts, or TTL level voltages (open collectors):

HIGH . .measured value is not less than HIGH limit.
IN . . . .measured value is less than HIGH limit and not less than LOW limit.

LOW ...measured value is less than LOW limit.

1-24. OPTION 101.

1-25. The 4262A Option 101 provides interfacing functions to both transfer L, C, R/ESR and D/Q data to HP Interface Bus line and to receive remote control signals from HP Interface Bus line.

1-26. OPTION 010.

1-27. The 4262A Option 010 provides test frequencies of 100Hz, 1kHz, and 10kHz (100Hz is used instead of standard 120Hz). All other electrical performance is the same as that of standard instrument.

1-28. OTHER OPTIONS.

1-29. The following options provides mechanical parts necessary for rack mounting and hand carrying:

Option 907: Front Handle Kit.
Option 908: Rack Flange Kit.
Option 909: Rack Flange and Front Handle Kit.

The installation procedures for these options are detailed in section II.

1-30. The 4262A Option 910 provides an extra copy of the operating and service manual.

1-31. ACCESSORIES SUPPLIED.

1-32. Figure 1-1 shows the HP Model 4262A LCR Meter, power cord (HP Part No. 8120-1378), and fuses (HP Part No. 2110-0007 and 2110-0202).

1-33. ACCESSORIES AVAILABLE.

1-34. For effective and easy measurement, three styles of fixtures and leads for the measurement of various components are available. These are listed in Table 1-1. A brief description of each of these fixtures and leads is given in Table 1-3. Refer to Section III Figure 3-3 on page 3-8 for detailed information on these devices.

Table 1-3. Accessories Available.

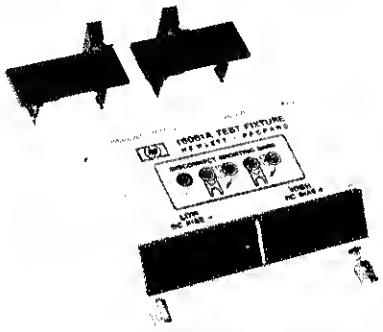
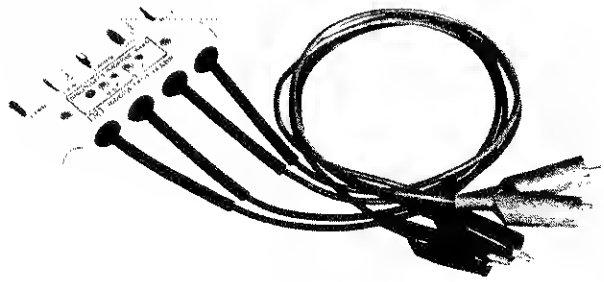
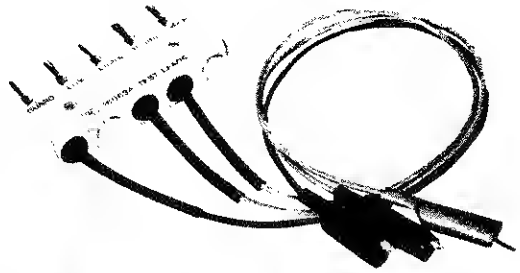
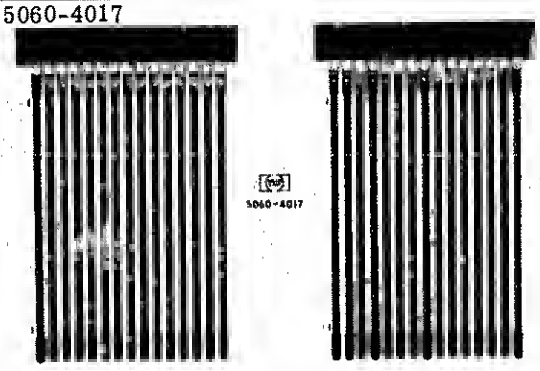
Model	Description
HP 16061A 	Test Fixture (direct coupled type) for general measurement of both axial and vertical lead components.
HP 16062A 	Test Leads (with alligator clips) useful for low inductance, high capacitance or low resistance (less than 10kΩ) measurements.
HP 16063A 	Test Leads (with alligator clips) for general component measurement and especially useful for high impedance measurements.
HP P/N 5060-4017 	Extender Board used for 4262A troubleshooting.

Table 1-4. Recommended Test Equipment.

Instrument	Critical Specifications	Recommended Model	*Use
Frequency Counter	Frequency Range: 40Hz to 10kHz Sensitivity: 50mVrms min.	HP 5300A/ w 5306A	P
Capacitance Standard (See para. 4-3)	Capacitance Values: 100pF, 1000pF, 10nF, 100nF, 1000nF and 10μF	GR Type 1413 GR Type 1417	P, A
Resistance Standard (See para. 4-3)	Resistance Values: 1kΩ, 10kΩ, 100kΩ and 10MΩ	GR Type 1443-Y	P, A
Inductance Standard (See Para. 4-3)	Inductance Value: 100mH	GR Type 1482-L	P
DC Voltmeter	Voltage Range: 1V to 10V Sensitivity: 10mV min.	HP 5300A/ w 5306A	P, A
Oscilloscope	Bandwidth: 10MHz min. Vertical Sensitivity: 5mV/div. Horizontal Sweep Rate: 1μs/div.	HP 1740A	A, T
Signature Analyzer		HP 5004A	T
Current Tracer		HP 547A	T
Service Kit	Signature Analysis Test Board	HP P/N: 04262-87002	T
DUT Box	Comprises L, C and R components whose values are calibrated at 120Hz and 1kHz.	HP 16361A	P, A
DUT Box	Comprises L, C and R components whose values are calibrated at 10kHz.	HP 16362A	P, A

*P=Performance Test A=Adjustments T=Troubleshooting

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section provides installation instructions for the Model 4262A LCR Meter. The section also includes information on initial inspection and damage claims, preparation for using the 4262A, packaging, storage, and shipment.

2-3. INITIAL INSPECTION.

2-4. The 4262A LCR Meter, as shipped from the factory, meets all the specifications listed in Table 1-1. On receipt, inspect the shipping container for damage. If the shipping container or cushioning material is damaged, notify the carrier as well as the Hewlett-Packard office and be sure to keep the shipping materials for carrier's inspection until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. The procedures for checking the general electrical operation are given in Section III (Paragraph 3-5 Basic Operating Check) and the procedures for checking the 4262A LCR Meter against its specifications are given in Section IV. Firstly, do the self test. If the 4262A LCR Meter is electrically questionable, then do the Performance Tests to determine whether the 4262A has failed or not. If contents are incomplete, if there is mechanical damage or defects (scratches, dents, broken switches, etc.), or if the performance does not meet the self test or performance tests, notify the nearest Hewlett-Packard office (see list at back of this manual). The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. PREPARATION FOR USE.

2-6. POWER REQUIREMENTS.

2-7. The 4262A requires a power source of 100, 120, 220Volts ac ±10%, or 240Volts ac +5%,-10%, 48 to 66Hz single phase. Power consumption is approximately 55 watts.

WARNING

IF THIS INSTRUMENT IS TO BE ENERGIZED VIA AN EXTERNAL AUTOTRANSFORMER FOR VOLTAGE REDUCTION, BE SURE THAT THE COMMON TERMINAL IS CONNECTED TO THE NEUTRAL POLE OF THE POWER SUPPLY.

2-8. LINE VOLTAGE AND FUSE SELECTION.

CAUTION

BEFORE TURNING THE 4262A LINE SWITCH TO ON, VERIFY THAT THE INSTRUMENT IS SET TO THE VOLTAGE OF THE POWER SUPPLIED.

2-9. Figure 2-1 provides instructions for line voltage and fuse selection. The line voltage selection card and the proper fuse are factory installed for the voltage appropriate to instrument destination.

CAUTION

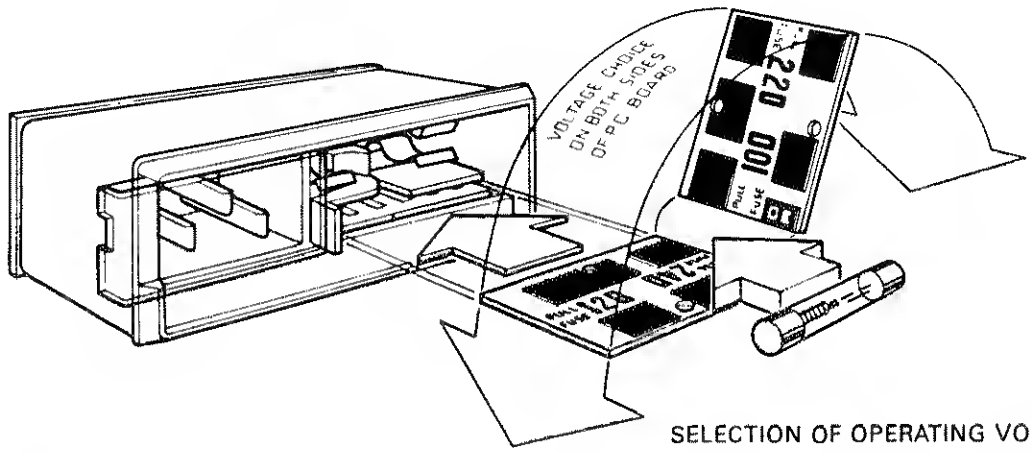
USE PROPER FUSE FOR LINE VOLTAGE SELECTED.

CAUTION

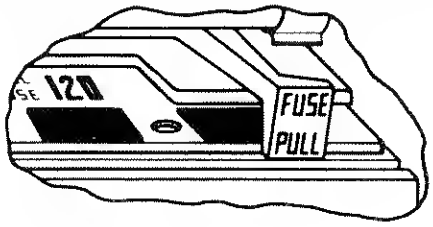
MAKE SURE THAT ONLY FUSES FOR THE REQUIRED RATED CURRENT AND OF THE SPECIFIED TYPE ARE USED FOR REPLACEMENT. THE USE OF MENDED FUSES AND THE SHORT-CIRCUITING OF FUSEHOLDERS MUST BE AVOIDED.

2-10. POWER CABLE.

2-11. To protect operating personnel, the



Operating voltage is shown in module window and is usually set to 120V at factory.



SELECTION OF OPERATING VOLTAGE

1. Disconnect power cable and slide module window to left.
2. Pull FUSE PULL lever and rotate to left. This removes line fuse.
3. Select operation voltage by orienting PC board to position desired voltage on top-left side. Push board firmly into module slot.
4. Rotate FUSE PULL lever back to its normal position and re-insert fuse in holder be careful to select correct fuse value.

Operating Voltage	Fuse	
	HP Part No.	Description
100Vac or 120Vac	2110-0007	1 A 250V Slow Blow
220Vac or 240Vac	2110-0202	0.5A 250V Slow Blow

Figure 2-1. Voltage and Fuse Selection.

National Electrical Manufacturer's Association (NEMA) recommends that the instrument panel and cabinet be grounded. The Model 4262A is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cable is the ground wire.

2-12. To preserve the protection feature when operating the instrument from a two contact outlet, use a three prong to two prong adapter (HP Part No. 5080-3149) and connect the green grounding tab on the adapter to power line ground.

CAUTION

THE MAINS PLUG MUST ONLY BE INSERTED IN A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD (POWER CABLE) WITHOUT PROTECTIVE CONDUCTOR (GROUNDING).

2-13. Figure 2-2 shows the available power cords, which may be used in various countries including the standard power cord furnished with the instrument. HP Part number, applicable standards for power plug, power cord color, electrical characteristics and countries using each power cord are listed in the figure. If assistance is needed for selecting the correct power cable, contact nearest Hewlett-Packard office.

2-14. Interconnections.

2-15. When an external bias is applied to the sample capacitor through DC BIAS input connectors on the 4262A rear panel, both plus and minus sides of the external power supply should be connected to the plus and minus sides of the 4262A EXT DC BIAS connector, respectively.

CAUTION

THE MAINS PLUG MUST BE INSERTED BEFORE EXTERNAL CONNECTIONS ARE MADE TO MEASURING AND/OR CONTROL CIRCUITS.

2-16. Operating Environment.

2-17. Temperature. The instrument may be operated in temperatures from 0°C to +55°C.

2-18. Humidity. The instrument may be operated in environments with relative humidities to 95% to 40°C. However, the instrument should be protected from temperature extremes which cause condensation within the instrument.

2-19. Installation Instructions.

2-20. The HP Model 4262A can be operated on the bench or in a rack mount. The 4262A is ready for bench operation as shipped from the factory. For bench operation a two-leg instrument stand is used. For use, the instrument stands are designed to be pulled towards the front of instrument.

2-21. Installation of Options 907, 908 and 909.

2-22. The 4262A can be installed in a rack and be operated as a component of a measurement system. Rack mounting information for the 4262A is presented in Figure 2-3.

2-23. STORAGE AND SHIPMENT.

2-24. Environment.

2-25. The instrument may be stored or shipped in environments within the following limits:

Temperature . . . . . -40°C to +75°C
Humidity. . . . . to 95%
Altitude. 50,000ft

The instrument should be protected from temperature extremes which cause condensation inside the instrument.

2-26. Packaging.

2-27. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-28. Otber Packaging. The following general instructions should be used for re-packing with commercially available materials:

a. Wrap instrument in heavy paper or plastic. If shipping to Hewlett-Packard office or service center, attach tag indicating type of service required, return address, model number, and full serial number.

b. Use strong shipping container. A double-wall carton made of 350 pound test material is adequate.

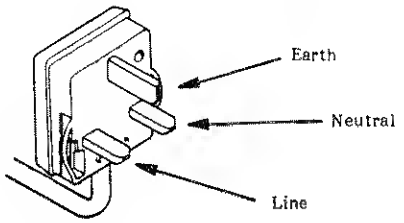
c. Use enough shock absorbing material (3 to 4 inch layer) around all sides of instrument to provide firm cushion and prevent movement inside container. Protect control panel with cardboard.

d. Seal shipping container securely.

e. Mark shipping container FRAGILE to ensure careful handling.

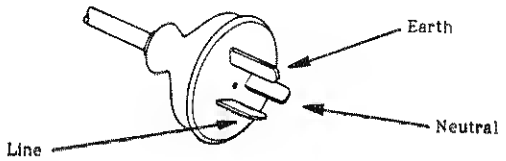
f. In any correspondence, refer to instrument by model number and full serial number.

OPTION 900 — United Kingdom



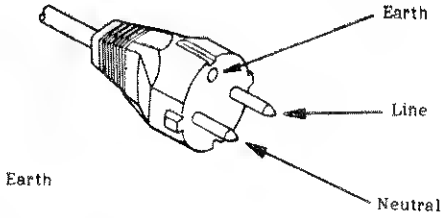
Plug : BS 1363A, 250V
Cable : HP 8120-1351

OPTION 901 — Australia/New Zealand



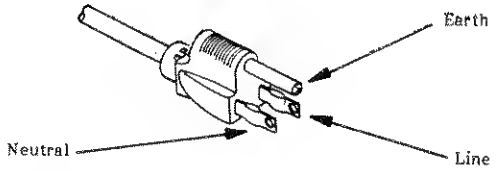
Plug : NZSS 198/AS C112, 250V
Cable : HP 8120-1369

OPTION 902 — European Continent



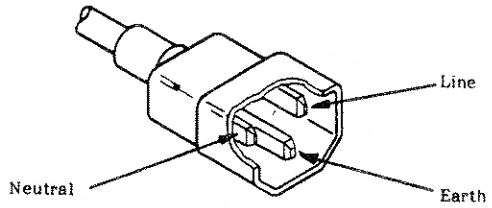
Plug : CEE-VII, 250V
Cable : HP 8120-1689

OPTION 903 — U.S./Canada



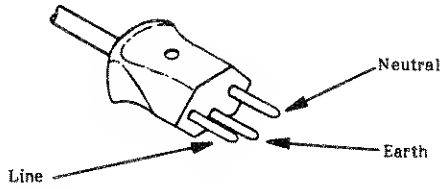
Plug : NEMA 5-15P, 125V, 15A
Cable : HP 8120-1378

OPTION 905* — Any country



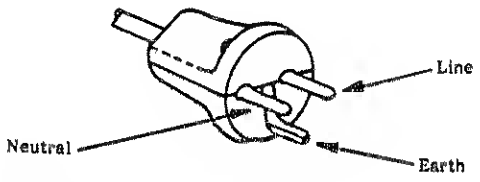
Plug : CEE 22-VI, 250V
Cable : HP 8120-1396

OPTION 906 — Switzerland



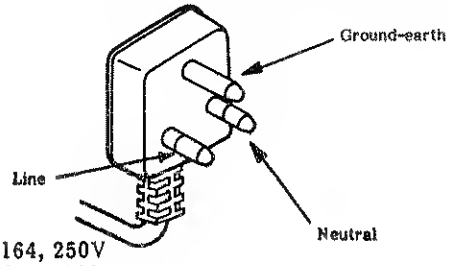
Plug : SEV 1011.1959-24507 Type 12, 250V
Cable : HP 8120-2104

OPTION 912 — Denmark



Plug : DHCR 107, 220V
Cable : HP 8120-2956

OPTION 917 — India/Republic of S.Africa



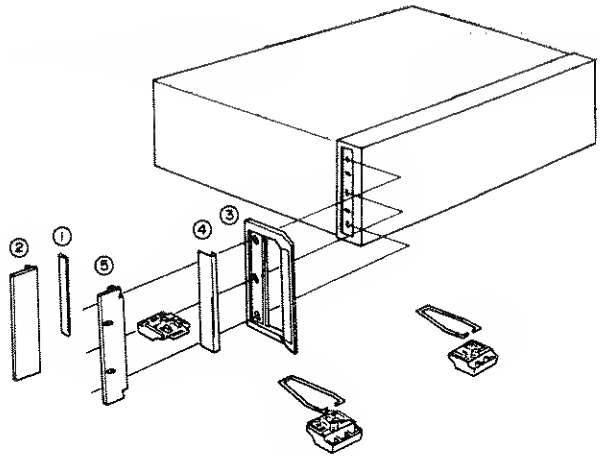
Plug: SABS 164, 250V
Cable: HP 8120-4211

NOTE: Each option number includes a 'family' of cords and connectors of various materials and plug body configurations (straight, 90 ° etc.).

* Plug option 905 is frequently used for interconnecting system components and peripherals.

Figure 2-2. Power Cables Supplied

Option	Description	Kit Part Number
907	Handle Kit	5061-9689
908	Rack Flange Kit	5061-9677
909	Rack Flange & Handle Kit	5061-9683



1. Remove adhesive-backed trim strips (1) from side at right and left front of instrument.
2. HANDLE INSTALLATION: Attach front handle (3) to sides at right and left front of instrument with screws provided and attach trim (4) to handle.
3. RACK MOUNTING: Attach rack mount flange (2) to sides at right and left front of instrument with screws provided.
4. HANDLE AND RACK MOUNTING: Attach front handle (3) and rack mount flange (5) together to sides at right and left front of instrument with screws provided.
5. When rack mounting (3 and 4 above), remove all four feet (lift bar at inner side of foot, and slide foot toward the bar).

Figure 2-3. Rack Mount Kit

2-29. OPTION INSTALLATION.

2-30. When it is desired to add one or two of the available optional features to a standard 4262A instrument, perform the installation as follows:

Refer to option installation illustrations on facing page.

a. Push LINE switch to off.

b. Remove instrument top cover.

c. Follow the appropriate paragraph below.

2-31. OPTION 001 BCD DATA OUTPUT INSTALLATION.

a. Remove the left side middle and lower blind covers from the rear panel.

b. Install two 50-pin connector assemblies in the openings.

c. Set BCD switch of SW1 on A23 board assembly (RED/ORANGE GUIDE, P/N: 04262-66523 or 04262-66623) from OFF to opposite position. This board is located third from front on the right side.

d. Connect cable attached to A23 board (shown below) between A23 and A35 BCD Option board assemblies (P/N: 04262-66535). Install A35 in RED/GREEN GUIDE option receptacle.

e. Plug 2 each flat cable assemblies from A35 BCD Option board into connector boards of rear panel connector assemblies.

f. Install instrument top cover.

2-32. OPTION 004 COMPARATOR INSTALLATION.

Refer to Fig 2-4 for installation procedure.

2-33. COUPLING OPTION 004 COMPARATOR WITH OPTION 001 BCD DATA OUTPUT INSTALLATION.

a. Set CMP (comparator) and BCD option switches of SW1 ON A23 board assemblies (RED/ORANGE GUIDE, P/N: 04262-66523 or 04262-66623) from OFF to opposite position. This board is located third from front on the right side.

b. Connect cables attached to A23 board between A23 and A24 comparator option BCD board assembly. No other cable assembly change is necessary for this combination of options.

c. Refer to Paragraphs 2-31 and 2-32 for other installation procedures.

2-34. OPTION 101 HP-IB REMOTE CONTROL AND DATA OUTPUT INSTALLATION.

a. Remove right side blind covers from rear panel.

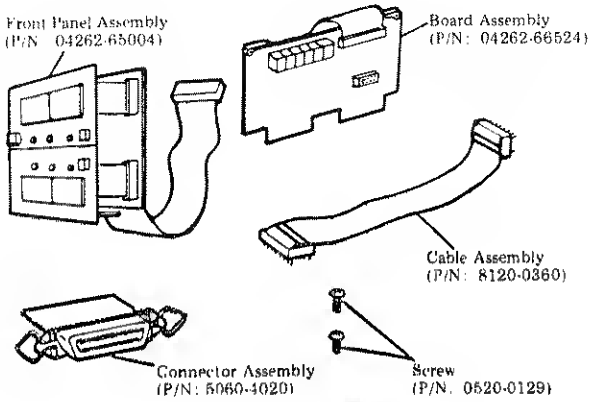
b. Install connector board assembly (P/N: 04262-66503) in the opening and mount with washers and nuts included with assembly.

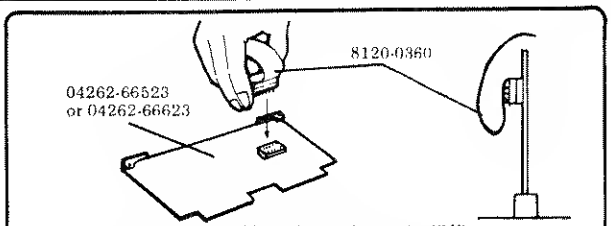
c. Set the HP-IB switch of SW1 on A23 board assembly from OFF to opposite position. The A23 board is located on the right side third from front.

d. Connect cable assembly attached to A25 board between A23 and A25 HP-IB option board assemblies (P/N: 04262-66525). Install A25 in RED/GREEN GUIDE option receptacle.

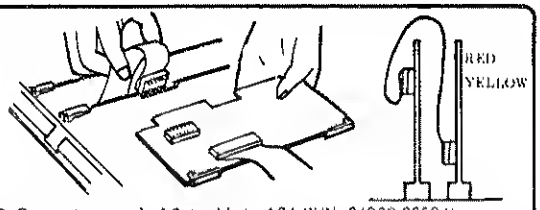
e. Plug flat cable assembly from connector board assembly P/N: 04262-66503 into A25 board assembly (installed in RED/GREEN GUIDE receptacle).

OPTION 101 IS NOT COMPATIBLE WITH OPTIONS 001 AND 004.

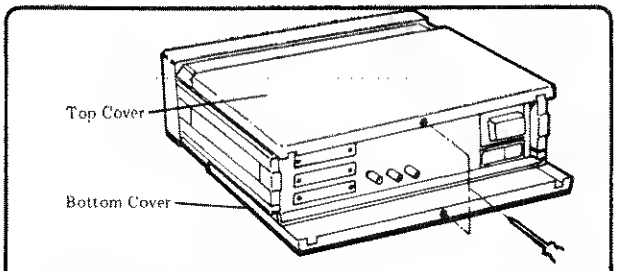




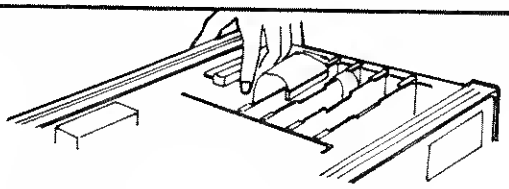
5. Connect cable assembly as shown above. Set CMP (comparator) of SW1 on A23 board (P/N: 04262-66523 or 04262-66623) from OFF to opposite position. Reinstall this board in socket with ORANGE/RED guide.



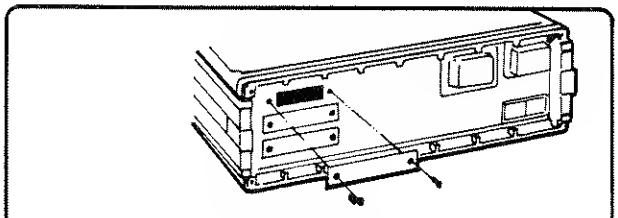
6. Connect one end of flat cable to A24 (P/N: 04262-66524) board. Install board in RED/YELLOW GUIDE.



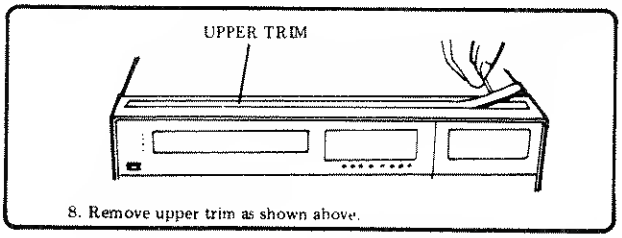
1. Remove top and bottom covers



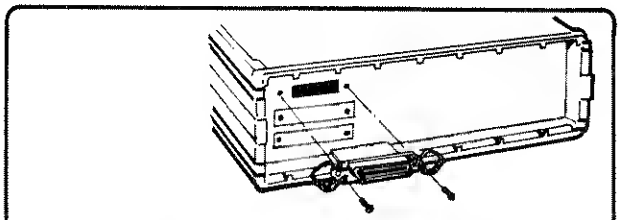
7. Plug flat cable assembly from A24 comparator option board to connector board of connector assembly on rear panel.



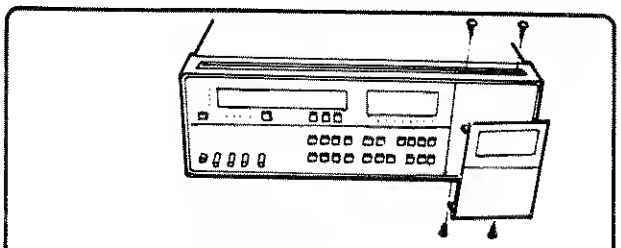
2. Remove upper blind cover from rear panel



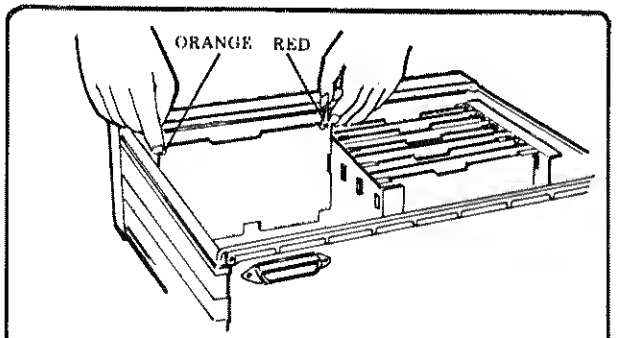
8. Remove upper trim as shown above.



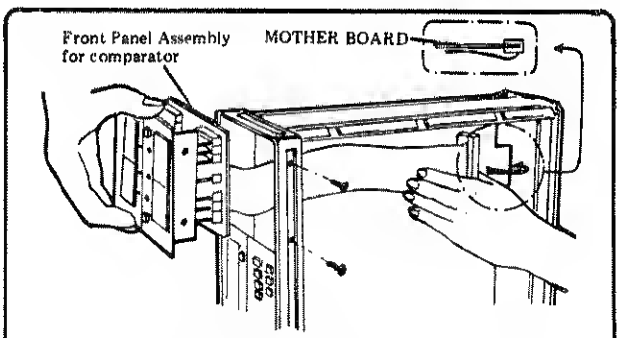
3. Install connector assembly.



9. Remove blank panel from right side of front panel.



4. Pull out board third from front on the right side as viewed from front panel (P/N: 04262-66523 or 04262-66623).



10. Install new front panel assembly and connect attached flat cable assembly to connector on mother board.

11. Install upper trim, top and bottom covers

Figure 2-4. Option Installation Illustrations.

Table 2-1. Option Components

Option	Function	Components		
		HP Part No.	Q'ty	Description
001	BCD Data Output	04262-66535	1	A35 Board Assembly
		5060-4020	2	Connector Board Assembly
		8120-0360	1	Flat Cable Assembly
004	Comparator	04262-65004	1	Front Panel Assembly
		04262-66524	1	A24 Board Assembly
		5060-4020	1	Connector Board Assembly
		8120-0360	1	Flat Cable Assembly
101	HP-IB Compatibility	04262-66525	1	A25 Board Assembly
		04262-66503	1	A3 Connector Board Assembly
		8120-0360	1	Flat Cable Assembly
		0380-0644	2	Stud for A3 Board Assembly
		2190-0577	2	Spring Washer

Note: To mount Connector Board assemblies, use rear panel blank plate retaining screws (Part No. 0520-0129) removed for the option installation.

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. This section provides the operating information to acquaint the user with the 4262A LCR Meter. Basic product features and characteristics, measurement procedures for various applications, an operational check of the fundamental electrical functions, and operator maintenance information is presented in this section. Operating cautions throughout the text should be carefully observed.

3-3. PANEL FEATURES.

3-4. Front and rear panel features for the 4262A are described in Figures 3-1 and 3-2. Description numbers match the numbers on the photographs. Other detailed information for panel displays and controls are covered in the Operating Instructions (paragraph 3-7).

3-5. SELF TEST (Basic Operating Check).

WARNING

ANY INTERRUPTION OF THE PROTECTIVE GROUNDING CONDUCTOR INSIDE OR OUTSIDE THE INSTRUMENT OR DISCONNECTION OF THE PROTECTIVE EARTH TERMINAL IS LIKELY TO CAUSE THE INSTRUMENT TO BE DANGEROUS. INTENTIONAL INTERRUPTION IS PROHIBITED.

WARNING

WHENEVER IT IS LIKELY THAT THE PROTECTION OFFERED BY FUSES HAS BEEN IMPAIRED, THE INSTRUMENT MUST BE MADE INOPERATIVE AND BE SECURED AGAINST ANY UNINTENDED OPERATION.

CAUTION

BEFORE ANY OTHER CONNECTION IS MADE, THE PROTECTIVE EARTH TERMINAL MUST BE CONNECTED TO A PROTECTIVE GROUNDING CONDUCTOR.

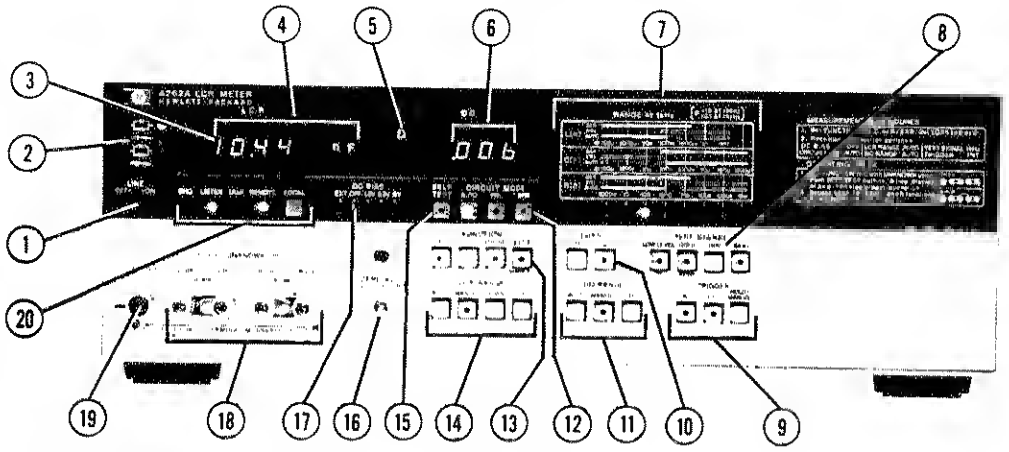
3-6. Functional operation of the Model 4262A should be confirmed by the SELF TEST switch before measuring samples of interest. This test can be done under all conditions of FUNCTION and TEST SIGNAL settings. Tests under certain combined conditions of FUNCTION and TEST SIGNAL settings are done for five ranges. A test for a range ends with a display of PASS (normal operation) or FAIL (abnormal operation) and then next range test is started. Range shifting for this test is done automatically from lower to higher.

All the combinations of FUNCTION and TEST SIGNAL switch settings are listed below. Even if the FUNCTION or TEST SIGNAL switch settings are limited for proposed sample measurement, all combined conditions should be tested.

Pushbutton Switch Setting *	UNKNOWN** Connectors
(C), (120 Hz), (SELF TEST)***	Open between HIGH side and Low side
(C), (1 kHz), (SELF TEST)	
(C), (10 kHz), (SELF TEST)	
(C), (LOW LEVEL), (10 kHz), (SELF TEST)	
(C), (LOW LEVEL), (1 kHz), (SELF TEST)	
(C), (LOW LEVEL), (120 Hz), (SELF TEST)	
(L), (120 Hz), (SELF TEST)	Short between HIGH side and LOW side.
(L), (1 kHz), (SELF TEST)	
(L), (10 kHz), (SELF TEST)	
(R/ESR), (10 kHz), (SELF TEST)	
(R/ESR), (1 kHz), (SELF TEST)	
(R/ESR), (120 Hz), (SELF TEST)	

* When FUNCTION or TEST SIGNALS switch setting is changed, the SELF TEST switch is automatically disabled. Therefore, whenever a new setting is made, push the SELF TEST switch again.

For ** see page 3-5



① LINE ON/OFF switch: Turns instrument on and readies instrument for measurement

② Circuit Mode Indicator: LED lamp, next to equivalent measuring circuit being used, lights. Sample connected to UNKNOWN terminals ⑱ is measured in an equivalent circuit selected by FUNCTION ⑬ and CIRCUIT MODE ⑫ switches and is indicated by appropriate LED lamp. Equivalent circuits are shown as electronic circuit symbols at the left of indicator lamps. Desired circuit parameter of component is measured in one of the following selected circuit modes:

Parallel capacitance Parallel resistance	
Series capacitance Series resistance	
Parallel inductance	
Series inductance Series resistance	

③ Trigger Lamp: Turns on during sample measuring period. Turns off during period when instrument is not taking measurement (or hold period). There is one turn-on-and-off cycle per measurement. This lamp turns on and off repeatedly when TRIGGER ⑨ is set to INT.

④ LCR Display: Inductance, capacitance or resistance value including the decimal point and unit is displayed in 3-½ digit decimal number from 0000 to 1999. If the sample value exceeds 1999 in a selected range, O-F(Over-Flow) appears in this display. This display also shows PASS or FAIL when SELF TEST is performed.

⑤ D/Q Indicator: In a capacitance or inductance measurement, this indicator indicates which of D (dissipation factor) or Q (quality factor) is displayed in D/Q display ⑥. In resistance measurement, this indicator is also lit (however, D or Q indication has no meaning and D/Q display ⑥ is left blank).

⑥ D/Q Display: Value for dissipation factor or quality factor is displayed in capacitance and/or inductance measurement. In resistance measurement, this display is kept blank.

⑦ RANGE Indicator: The range automatically or manually selected is indicated by LED lamp. The table printed above the LED array shows the measurement ranges of the Model 4262A.

⑧ TEST SIGNAL These pushbuttons enable selection of measurement frequency—120Hz, 1kHz or 10kHz and that of low test voltage of the signal applied to sample to be tested. LOW LEVEL switch is effective only in parallel capacitance measurements, supplying a test voltage of 50mVrms. For units equipped with option 010, arrow on pushbutton (120Hz) points to 100Hz.

Figure 3-1. Front Panel Features (sheet 1 of 2).

⑨ TRIGGER: These pushbuttons select trigger mode, INT, EXT or HOLD/MANUAL. INT key provides internal trigger which enables instrument to make repeated automatic measurements. In external trigger mode (EXT), trigger signal should be applied to either of following two connectors: (1) EXT TRIGGER input connector on the rear panel (2) 50 pin connector of Option 001 or 004 on the rear panel. HOLD/MANUAL trigger mode provides trigger signal for one measurement cycle when this key is depressed.

⑩ LOSS: These pushbuttons select whether D or Q value is displayed in the D/Q display ⑥ in capacitance or inductance measurements.

⑪ D/Q RANGE: These pushbuttons select ranging method for loss measurement.
AUTO: Optimum D/Q range is selected by internal logic circuit.
MANUAL: D/Q range is fixed to a range. Range change is done by depressing the STEP key on the right.

⑫ CIRCUIT MODE: Appropriate circuit mode for taking a measurement is selected and set with these pushbuttons. A parallel equivalent circuit is selected by PRL key and series equivalent circuit by SER key. When AUTO key is pushed, the instrument automatically selects the appropriate parallel or series equivalent circuit.

⑬ FUNCTION: These pushbuttons select electrical circuit parameter to be measured as follows:

C: Capacitance together with dissipation factor (D) or quality factor (Q).

L: Inductance with dissipation factor (D) or quality factor (Q).

R/ESR: Resistance or Equivalent Series Resistance.

△LCR: Difference in L, C, or R value between the value of the sample under test and the internally stored value obtained by a measurement just before △LCR key is depressed.

⑭ LCR RANGE: These pushbuttons select ranging method for LCR measurement.

AUTO: Optimum range for the sample value is automatically selected.

MANUAL: Measurement range is fixed (even when the sample connected to the UNKNOWN terminals is changed). Range change is done by depressing DOWN or UP key on the right.

⑮ SELF TEST: This pushbutton performs automatic check for checking the basic operation of Model 4262A. If normal operation is confirmed, "PASS" is displayed in LCR display ④. If wrong performance is detected, a display of "FAIL" appears. See paragraph 3-5 for details.

⑯ ZERO Adjustment Controls: These adjustments provide proper compensation for cancelling stray capacitance and residual inductance which are present when a test fixture is mounted on the UNKNOWN terminals. Connectors are kept open for cancelling stray capacitance and shorted for cancelling residual inductance.

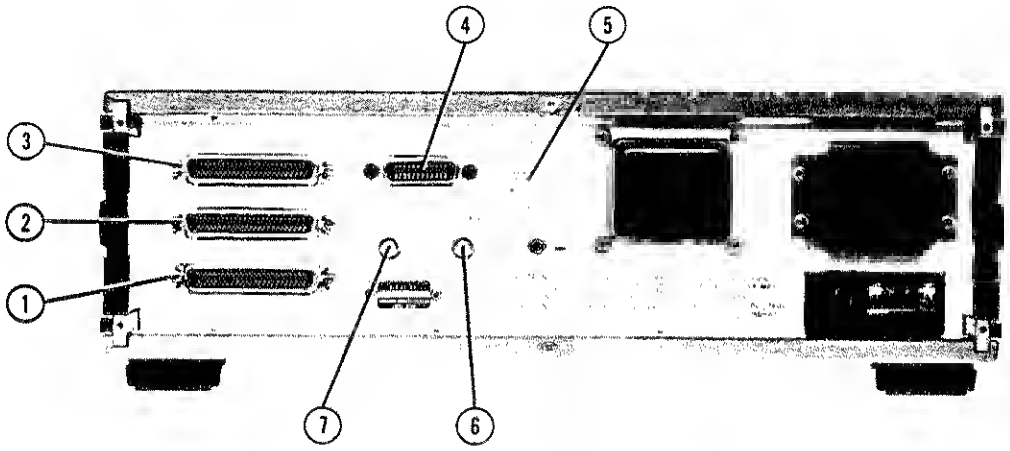
⑰ DC BIAS Selector Switch: This switch permits selection of internal DC bias voltage applied to sample (1.5Vdc, 2.2Vdc, or 6.0Vdc). When switch is set to EXT, it is used to apply external bias voltage from rear DC BIAS input connectors. OFF position is selected if no bias voltage is necessary.

⑱ UNKNOWN Terminals: Consist of four terminals: High current terminal (HCUR), High potential terminal (HPOT), Low potential terminal (LPOT) and Low current terminal (LCUR). A five-terminal configuration is constructed by adding the GUARD terminal ⑲. A three-terminal configuration is constructed by shorting High terminals and Low terminals together with shorting bars. Under DC Bias operation, the high terminals have a positive DC voltage with respect to LOW terminals.

⑲ GUARD Terminal: This is connected to chassis ground of instrument and can be used as Guard terminal for increasing accuracy in certain measurements.

⑳ HP-IB Status Indicator and LOCAL switch. LED lamps for SRQ, LISTEN, TALK, and REMOTE which indicate status of interface between the 4262A (Option 101) and HP-IB controller. LOCAL switch enables front panel controls instead of remote control signals from HP-IB line.

Figure 3-1. Front Panel Features (sheet 2 of 2).



① BCD D/Q DATA OUTPUT Connector: BCD parallel data of measured dissipation factor (D) or quality factor (Q) are outputted through this 50 pin connector installed on the 4262A Option 001.

② BCD LCR DATA OUTPUT Connector: With Option 001, BCD parallel data for inductance, capacitance and resistance measured values are outputted through this 50 pin connector.

③ COMPARATOR OUTPUT Connector: The 4262A Option 004 provides comparator decision outputs for LCR and D/Q through this 50 pin connector.

④ HP-IB Digital Bus Connector: This 24 pin connector conveys bus signals and remote programming instructions to the 4262A Option 101 and transmits data from the 4262A Option 101 to the bus.

⑤ Address Switch: This seven section switch sets address code of 4262A Option 101 and TALK ONLY or ADDRESSABLE mode of operation.

⑥ EXT DC BIAS Connector: External dc bias voltage can be applied to the sample up to the maximum voltage of plus 40V through this connector.

⑦ EXT TRIGGER Connector: This connector is used for externally triggering the instrument by inputting an external trigger signal. TRIGGER SWITCH on front panel should be set to EXT.

Figure 3-2. Rear Panel Features.

** Two HIGH side terminals and two LOW side terminals should be connected with the shorting strap, for each configuration of the UNKNOWN terminals. When the UNKNOWN terminal configuration is not appropriate, for example, shorted (C) or open (L), display will show FAIL 1 (because they result from different causes, FAIL 2 or FAIL 3 are rarely displayed).

*** Setting change required is only the underlined switch setting.

If FAIL is displayed, check the UNKNOWN terminal configurations as follows:

(1) That the two HIGH side terminals (HCUR - HPOT) and the two LOW side terminals (LCUR - LPOT) are properly shorted.

(2) That short or open conditions properly exist between HIGH and LOW side terminals.

(3) That GUARD terminal is isolated (open) from both of HIGH and LOW terminals.

If FAIL is still displayed (under the above condition), notify the nearest Hewlett-Packard office with information detailing which combination of settings show FAIL.

During SELF TEST, other controls are automatically set as follows:

CIRCUIT MODE.... SER when FUNCTION is set to L or R/ESR. PRL when FUNCTION is set to C.
LOSS..... D
LCR RANGE .....MANUAL
D/Q RANGE.....MANUAL
TRIGGER..... INT

NOTE

TO ENSURE CORRECT RESULTS OF SELF-TEST OPERATION IN L AND R MEASUREMENT FUNCTIONS, CONNECT ALL (HIGH AND LOW SIDE) UNKNOWN TERMINALS TOGETHER WITH A LOW IMPEDANCE STRAP (IF THIS SHORT-CIRCUIT IS MADE AT THE ENDS OF THE TEST LEADS, CORRECT RESULTS MAY NOT OCCUR).

3-7. TEST SIGNALS.

3-8. Three test signal frequencies are available: these are 120Hz, 1kHz and 10kHz sinusoidal waveforms which have a frequency accuracy of 3%. The typical voltage applied to the sample or current flowing through the sample is specified in Table 3-1 for all test signal frequencies. A constant test voltage is supplied to the sample when measuring parallel parameters Lp, Cp, and Rp. The constant current method is adopted for the measurement of Ls, Cs, and Rs. The 50mVrms test voltage is used only for Cp measurement.

3-9. MEASUREMENT RANGE.

3-10. As given in Table 3-2, the 4262A has wide measurement ranges. Seven or eight ranges are available (depending upon measurement function) and the appropriate range is automatically selected for the value of sample connected to the 4262A UNKNOWN terminals. For applications which require a fixed measurement range (such applications are sometimes needed, for example, in inductance measurements), manual range control is push-button selectable. Four or five ranges, however, are used in the series and parallel equivalent circuit measurement modes. When the CIRCUIT MODE is set to AUTO, the 4262A will automatically select the appropriate circuit mode, range over the measurement ranges shadowed in Table 3-2, settle on the proper range, and measure the sample.

Table 3-1. Sample Voltage or Current.

RANGE	CIRCUIT MODE					
	Ls	Lp	Cs	Cp	Rs	Rp
1	40mA rms	———	———	1Vrms (50mVrms)*	40mA rms	———
2	10mA rms	———	———	1Vrms (50mVrms)*	10mA rms	———
3	1mA rms	———	———	1Vrms (50mVrms)*	1mA rms	———
4	100 μA rms	1V rms	10 μA rms	1Vrms (50mVrms)*	100 μA rms	1V rms
5	10 μA rms	1V rms	100 μA rms	1Vrms (50mVrms)*	10 μA rms	1V rms
6	———	1V rms	1 μA rms	———	———	1V rms
7	———	1V rms	10mA rms	———	———	1V rms
8	———	———	40mArms	———	———	1V rms

*When TEST SIGNAL is set to LOW LEVEL.

Table 3-2. Measurement Ranges.

CIRCUIT MODE	TEST SIGNAL Frequency	Range							
		1	2	3	4	5	6	7	8
Lp	120 Hz 1 kHz 10 kHz				0000 mH 000.0 mH 00.00 mH	00.00 H 0000 mH 000.0 mH	000.0 H 00.00 H 0000 mH	0000 H 000.0 H 00.00 H	
Ls	120 Hz 1 kHz 10 kHz	0000 μH 000.0 μH 00.00 μH	00.00 mH 0000 μH 000.0 μH	000.0 mH 00.00 mH 0000 μH	0000 mH 000.0 mH 00.00 mH	00.00 H 0000 mH 000.0 mH			
Cp	120 Hz 1 kHz 10 kHz	0000 pF 000.0 pF 00.00 pF	00.00 nF 0000 pF 000.0 pF	000.0 nF 00.00 nF 0000 pF	0000 nF 000.0 nF 00.00 nF	00.00 μF 0000 nF 000.0 nF			
Cs	120 Hz 1 kHz 10 kHz				0000 nF 000.0 nF 00.00 nF	00.00 μF 0000 nF 000.0 nF	000.0 μF 00.00 μF 0000 nF	0000 μF 000.0 μF 00.00 μF	00.00 mF 0000 μF 000.0 μF
Rp	120 Hz 1 kHz 10 kHz				0000 Ω 0000 Ω 0000 Ω	00.00 kΩ 00.00 kΩ 00.00 kΩ	000.0 kΩ 000.0 kΩ 000.0 kΩ	0000 kΩ 0000 kΩ 0000 kΩ	00.00 MΩ 00.00 MΩ 00.00 MΩ
Rs	120 Hz 1 kHz 10 kHz	0000 mΩ 0000 mΩ 0000 mΩ	00.00 Ω 00.00 Ω 00.00 Ω	000.0 Ω 000.0 Ω 000.0 Ω	0000 Ω 0000 Ω 0000 Ω	00.00 kΩ 00.00 kΩ 00.00 kΩ			

Note: 0000μH indicates a range of 0001μH to 1999μH (and similarly for F and Ω).

3-11. INITIAL DISPLAY TEST.

3-12. The Model 4262A automatically performs a front panel LED display test for a few seconds after instrument is tuned on (after LINE button is depressed). The display test sequence is:

1. All front panel indicator lamps, except numeric segments and multiplier indicator lamps will illuminate. (SRQ, LISTEN, TALK and REMOTE lamps illuminate only when HP-IB option is installed).

2. Front panel pushbutton LED's and indicator lamps indicate that automatic initial settings (see Paragraph 3-13 which follows) have been set. Simultaneously, the LCR DISPLAY and DQ DISPLAY readouts are tested. All numeric displays show figures of 8 (⊟) and multiplier indicators (p n μ m k M) light in turn.

3. Range indicator lamps step from right (upper range) to left (lower range). When steps 1, 2 and 3 have been completed, the trigger lamp begins to flash. Figures on numeric displays change to meaningful numbers showing that the 4262A is ready to take a measurement.

3-13. INITIAL CONTROL SETTINGS.

3-14. One of the sophisticated features of the 4262A is its automatic initial control setting function. After the instrument is turned on, the front panel control functions are automatically set as follows:

SELF TEST	OFF
CIRCUIT MODE	AUTO
FUNCTION	C
LCR RANGE	AUTO
LOSS	D
DQ RANGE	AUTO
TEST SIGNAL	1kHz
TRIGGER	INT

As these initial settings provide the general capacitance measurement eonditions applicable to a broad range of capacitance measurements, a capacitance can be usually measured by merely connecting the sample to the UNKNOWN terminals. Inductance or resistance can be measured by pressing the L FUNCTION or R/ESR FUNCTION buttons, as appropriate. When a different measurement is to be attempted, press appropriate pushbuttons and select desired functions.

3-15. D/Q MEASUREMENT.

3-16. The Model 4262A makes a loss measurement along with capacitance or inductance measurements on each measurement cycle. The measured loss factor is displayed in the form of the dissipation (D) or quality (Q) factor of the sample. The D or Q function is pushbutton selectable in both L and C measurements. D and Q measurement ranges are:

D:	2 ranges	.001 to 1.999
		0.01 to 19.9
Q:	4 ranges	.050 to 1.996
		0.05 to 19.61
		00.1 to 166.7
		001 to 1000

The D range, appropriate to the value of the sample is automatically selected. Alternately, a manual D range control is pushbutton selectable. Quality factor (Q) is calculated as a reciprocal dissipation number from the measured D value. Hence, the Q readout display will skip some numbers when low dissipation samples are measured. For example, when the dissipation measured is .010, the quality factor display is 100. When dissipation is .009, the quality factor reading is 111 (Q readings of 101 to 110 are not obtained). On the high D measurement range, the readout is displayed in 3 digits.

3-17. △LCR MEASUREMENT.

3-18. When many components of similar value are to be tested, it is sometimes more practicable to measure the difference between the value of the sample and a predetermined reference value. The △LCR function permits repetitive calculation of the difference between the reference and each individual sample and to display the result on the LCR DISPLAY. When the △LCR FUNCTION button is pressed, the inductance, capacitance, or resistance value of the sample is stored in an internal memory. The 4262A will now display the difference between the stored value and the measured value of a sample connected to UNKNOWN. The LCR RANGE is automatically held in MANUAL for the duration of △LCR measurements (if another pushbutton is inadvertently pressed, the △LCR measurement function will be reset and will require reactivating).

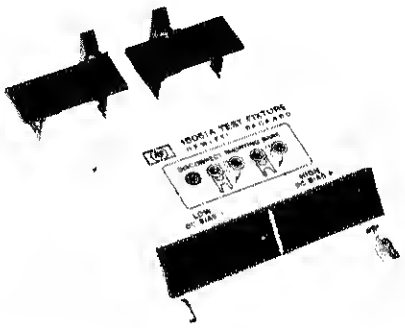
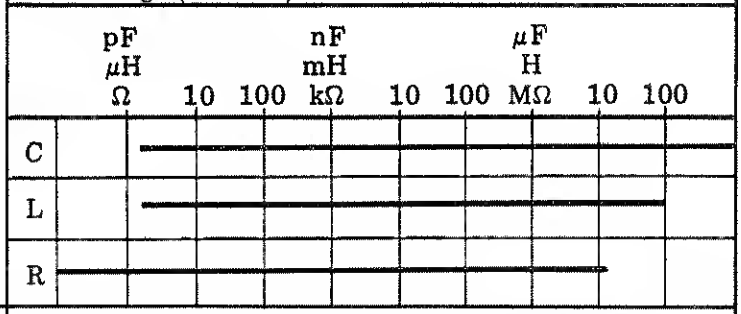
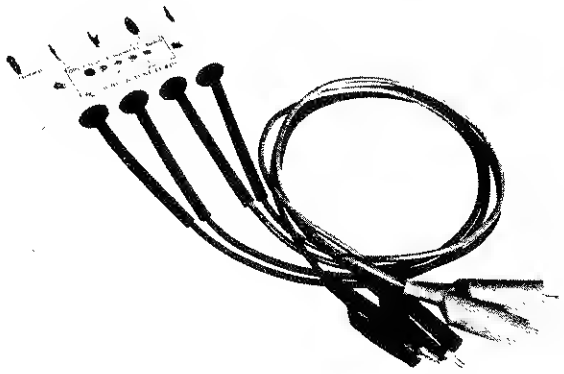
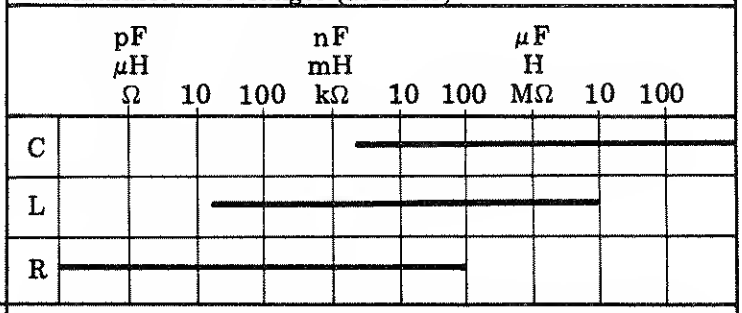
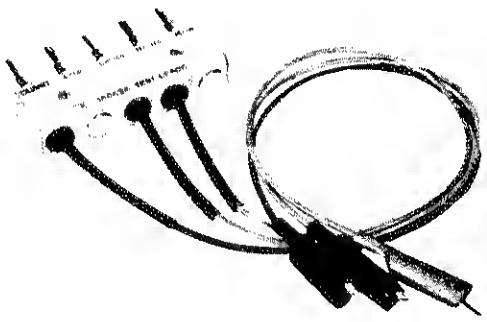
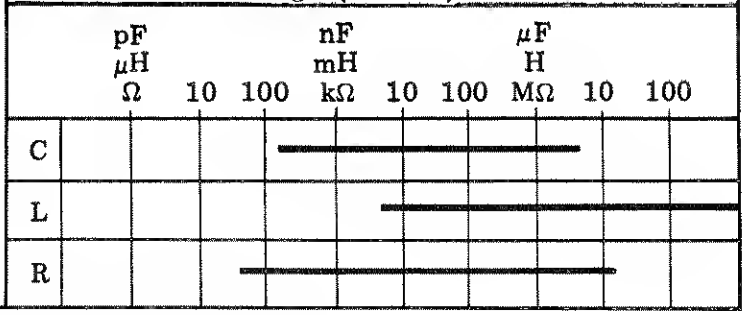
Accessory Model	Characteristics
16061A Test Fixture  Five terminal construction test fixture.	This fixture facilitates easy measurement of general type components with axial or vertical leads. To install fixture, disconnect shorting bars between high terminals and between low terminals. Insert fixture screws to firmly attach fixture to instrument. Two kinds of inserts are included (for components with either axial or vertical leads). DUT range (at 1kHz) 
16062A Test Leads  Test Leads for four terminal measurement (does not contain guard conductor).	The 16062A is especially useful when measuring low impedances. DUT values measurable with the 16062A are diagrammed below. If the measuring sample is more than approx. 300μF at 1kHz or less than approx. 100μH at 1kHz, it is recommended that the respective potential leads and current leads be twisted together. Measurable DUT ranges (at 1kHz) 
16063A Test Leads  Coaxial test leads with guard conductor for three terminal measurement.	The 16063A is particularly useful when measuring high impedances. DUT values measurable with the 16063A are diagrammed below. This test lead set is not intended to be used for the accurate measurement of small capacitances (less than approx. 100pF) due to the residual capacitance of the leads. Measurable DUT ranges (at 1kHz) 

Figure 3-3. Test Fixture and Leads.

3-19. D/Q Blanking Function (Switch selectable function inside cabinet).

3-20. The D/Q blanking function permits deactivating the D/Q measurement as desired. If operator has no need of D/Q measurement data, and alternatively desires to make higher speed LCR measurements, the switch for this function may be set. When the D/Q function is deactivated, measurement time is shortened to approximately 220 to 250 milliseconds (at 120Hz) and to 80 to 110 milliseconds (at 1kHz and 10kHz) as compared to standard measuring times (which includes a D/Q measurement). The D/Q deactivating switch is located on the A23 board assembly. To select this function, change setting of the switch as follows:

a. Remove top cover.

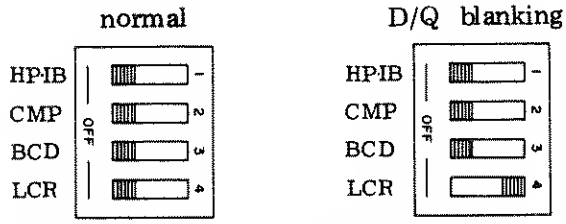
b. Take out A23 board (red and orange colored extractors).

c. The selection switch is mounted near left edge of the A23 board.

d. Change position of the switch as illustrated below.

e. Reinstall the A23 board in its normal position.

f. Replace top cover.



3-21. General Component Measurement.

3-22. Figure 3-7 shows the operating procedures for measuring an L, C or R (inductance, capacitance or resistance) circuit component. Almost all discrete circuit components (inductors, capacitors or resistors)except for components having special shapes or dimensions can be measured with this setup. Special components may be measured by using Test Leads 16062A or 16063A or by specially designed user built fixtures instead of 16061A Test Fixture.

3-23. Semiconductor Device Measurement.

3-24. The procedures for using the 4262A semiconductor device measurement capabilities are described in Figure 3-8. For example, the junction (interterminal) capacitance of diodes, collector output capacitance of transistors, etc., can easily and accurately be measured (with and without dc bias).

3-25. External DC Bias.

3-26. A special biasing circuit using external voltage or current bias, as needed for capacitor or inductor measurements, is illustrated in Figure 3-9. The figure shows sample circuitry appropriate to 4262A applications. Biasing circuits must avoid permitting dc current to flow into the 4262A as dc current increases the measurement error and the excess current sometimes may cause damage to the instrument. When applying a dc voltage to capacitors, be sure applied voltage does not exceed maximum working voltage and that you are observing polarity of capacitor. Note that the external bias voltage is present at H CUR and H POT terminals.

3-27. Bias Voltage Settling Time. When a measurement with dc bias voltage superposed is performed, it takes some time for voltage across sample to reach a certain percentage of applied (desired) voltage. Figure 3-9 shows time for dc bias voltage to reach more than 99% of applied voltage and for 4262A to display a stable value. If the bias voltage across sample is not given sufficient time to settle, the displayed value may fluctuate or O-F may be displayed. Read measured value after display settles.

3-28. External Triggering.

3-29. For triggering the 4262A externally, connect an external triggering device to the rear panel EXT TRIGGER connector (BNC type) and press EXT TRIGGER button. The 4262A can be triggered by a TTL level signal that changes from low (0V) to high level (+5V). Triggering can be also done by alternately shorting and opening the center conductor of the EXT TRIGGER connector to ground (chassis).

Note

The center conductor of the EXT TRIGGER connector is normally at high level (no input).

3-30. TERMINAL CONFIGURATION.

3-31. Connection of DUT. The 4262A Unknown terminals consists of five binding post (type) connectors: HCUR, HPOT, LCUR, LPOT and GUARD. By connecting the stationary shorting straps to appropriate terminals, the UNKNOWN terminals can be adopted for the desired measurement terminal configuration: the two, three, four or five terminal method.

For measurements of samples having a medium order of impedance (100Ω to 10kΩ), the convenient two terminal method is suited to measurement requirements for good accuracy as well as for ease in connecting the sample. When converting to two terminals, shorting straps are attached to the UNKNOWN HCUR and HPOT terminals, and LCUR and LPOT terminals, respectively.

High impedance samples (greater than 1kΩ) -- which includes low capacitance, high inductance and high resistance -- should be measured by the three terminal method to eliminate the effects of stray capacitances on the measurements. For this purpose, the guard conductor of the sample is connected to the instrument GUARD terminal.

In the measurement of low impedance samples (less than 1kΩ), efforts should be made to eliminate the effects of contact resistance, lead resistance, residual inductance and other residual parameters in the measuring apparatus. Four terminal configuration measurements allow stable, accurate measurement of high capacitance, low inductance and low resistance samples at minimum incremental errors in the measurement of low impedance samples. In the four terminal method, the shorting straps are disconnected to separate potential leads from current leads. Thereby, the characteristics of the sample can be precisely determined by the instrument irrespective of the various residual parameters present in the measuring signal current path. To ensure the best accuracy, the potential leads should be connected near to the sample.

The five terminal method, which adds the guard conductor to the four terminal configuration, expands the applicable measurement range into the higher impedance regions. Thus, this method covers a broad range of measurements from low to high impedance samples at the measuring frequency of the 4262A.

When test fixtures and test leads used have a shielding conductor and are designed to consider residual impedance, the measurement limitations described above for the individual terminal configurations can vary to some extent depending on the particular characteristics of the fixture and connections. Three accessories, the 16061A Test Fixture, the 16062A Test Leads, and the 16063A Test Leads are available. The characteristics of these accessories and applicable measurement ranges are outlined in Figure 3-3. These accessories make it easy to construct the desired terminal configuration.

IMPORTANT !

FOR CERTAIN TERMINAL MEASUREMENT CONFIGURATIONS, THE HCUR TERMINAL MUST BE CONNECTED TO HPOT TERMINAL AND THE LCUR TERMINAL CONNECTED TO THE LPOT TERMINAL. OTHERWISE, THE DISPLAYS WILL HAVE NO MEANING AND THE LIFE OF THE RELAYS USED IN THE INSTRUMENT WILL SOMETIMES BE SHORTENED.

Note

The 4262A can not measure a sample which has one lead connected to earth (grounded).

3-32. OFFSET ADJUSTMENT.

3-33. Since test fixtures and test leads have different inherent stray capacitances and residual inductances, the measured value obtained with respect to the same sample may possibly differ depending on the test fixture (leads) used. These residual factors can be read from the 4262A display by properly terminating (short or open) the measurement terminals of the test jig. The front panel C ZERO ADJ and L ZERO ADJ controls permit compensation for these residual factors and can eliminate measurement errors due to the test jig. The capacitance or inductance readout can be set to zero for the particular test jig used with the instrument. In capacitance and inductance measurements, an incomplete offset adjustment causes two types errors:

1) Deviation from zero counts.

   When a small capacity or a small inductance is measured, the measured capacitance (inductance) value becomes the sum of the capacitance (inductance) of sample and the stray capacitance (residual inductance) of test jig. The effects of the residual factors are:

   $$Cm = Cx + Cst$$
   $$Lm = Lx + Lres$$

   Wbere, subscripts are

   m: measured value.
   x: value of sample.
   st: stray capacitance.
   res: residual inductance.

   Both Cst and Lres cause the same measurement error and are independent of sample value.

2) Influence on high capacitance and high inductance measurements.

When a high inductance (a high capacitance) is measured, the residual factors in the test jig also contribute a measurement error. The affect of stray capacitance or residual inductance on measurement parameters are:

Stray capacitance	→ Offsets high inductance measurements.
Residual inductance	→ Offsets high capacitance measurements.

These measurement errors increase in proportional to the square of the test signal frequency. The effects of the residual factors can be expressed as follows:

$$Cm = \frac{Cx}{1 - \omega^2 CxLres}$$

$$\text{or} \quad \left(\frac{Cm - Cx}{Cm} \approx \omega^2 CxLres \right)$$

$$Lm = \frac{Lx}{1 - \omega^2 LxCst}$$

$$\text{or} \quad \left(\frac{Lm - Lx}{Lm} \approx \omega^2 LxCst \right)$$

In a 10kHz measurement, for the measurement error to be less than 0.1%, the product of Cx and Lres (Lx and Cst) should be less than 0.25×10^{-12}. The relationship between the residual factors of the test jig and measurement accuracies are graphically shown in Figure 3-4.

The 4262A ZERO ADJ controls cover the following capacitance and inductance offset adjustment ranges:

C ZERO ADJ: up to 10pF
L ZERO ADJ: up to 1 μH

An offset adjustment should always be performed before measurements are taken.

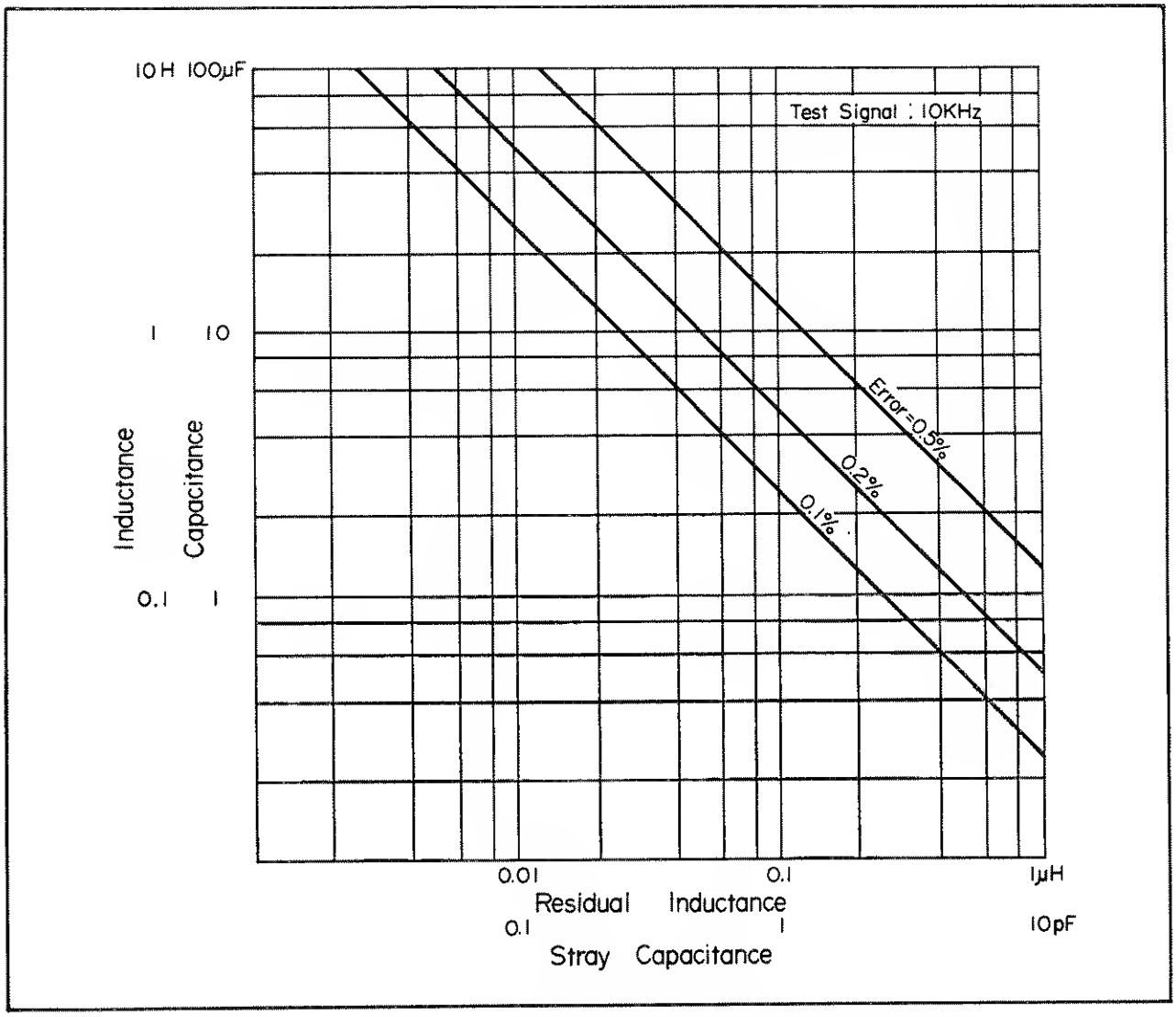


Figure 3-4. Measurement Error due to Misadjusted ZERO ADJ Controls.

Measurement Parameter Conversions

Parameter values for a component measured in a parallel equivalent circuit and that measured in series equivalent circuit are different from each other. For example, the parallel capacitance of a given component is not equal to the series capacitance of that component. Figure A shows the relationships between parallel and series parameters for various values of D. Applicable diagrams and equations are given in the chart. For example, a parallel capacitancc (Cp) of 1000pF with a dissipation factor of 0.5, is equivalent to a series capacitance (Cs) value of 1250pF at 1kHz. As shown in Figure A, inductance or capacitance values for parallel and series equivalents are almost identical when the dissipation factor is less than 0.01. The letter D in Figure A represents dissipation factor and is calculated by the equations presented in Table A for each circuit mode. The dissipation factor of a component always has the same dissipation factor at a given frequency for both parallel equivalent and series equivalent circuits.

Note

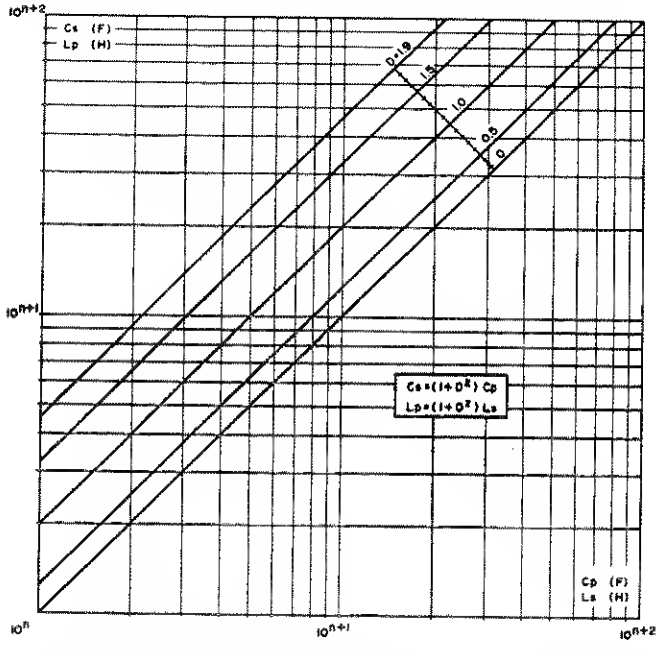
Dissipation factors displayed when CIRCUIT MODE is switched between PRL and SER may exhibit slight differences due to the measurement accuracy of the 4262A.

The reciprocal of the dissipation factor (D) is quality factor (Q) and D is often represented as tan δ which is the tangent of the dissipation angle (δ). Figure 3-6 is a graphical presentation of the equations in Table A. For example, a series inductance of 1000μH which has a dissipation factor of 0.5 at 1kHz has a series resistance of 3.14 ohms.

Table A. Dissipation Factor Equations.

Circuit Mode		Dissipation Factor	Conversion to other modes
Cp mode		$D = \frac{1}{2\pi fCpRp} \left(= \frac{1}{Q}\right)$	$Cs = (1 + D^2)Cp$, $Rs = \frac{D^2}{1 + D^2} \cdot Rp$
Cs mode		$D = 2\pi fCsRs \left(= \frac{1}{Q}\right)$	$Cp = \frac{1}{1 + D^2}$ Cs, $Rp = \frac{1 + D^2}{D^2} \cdot Rs$
Lp mode		$D = \frac{2\pi fLp}{Rp} \left(= \frac{1}{Q}\right)$	$Ls = \frac{1}{1 + D^2}$ Lp, $Rs = \frac{D^2}{1 + D^2} \cdot Rp$
Ls mode		$D = \frac{Rs}{2\pi fLs} \left(= \frac{1}{Q}\right)$	$Lp = (1 + D^2)Ls$, $Rp = \frac{1 + D^2}{D^2} \cdot Rs$

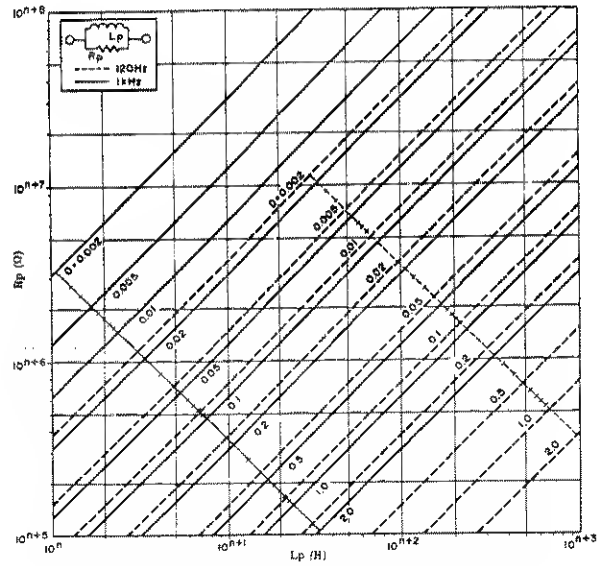
*f: Test signal frequency.



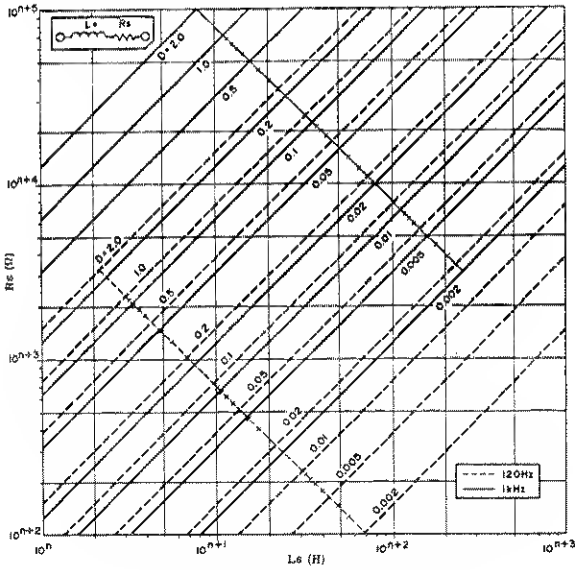
Where n stands for a free integer.

FigureA. Relationships between Parallel and Series Parameters.

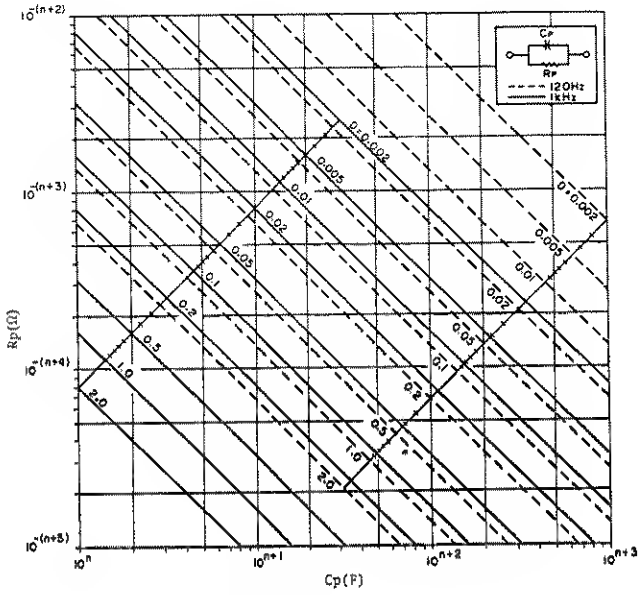
Figure 3-5. Conversion Between Parallel and Series Equivalents.



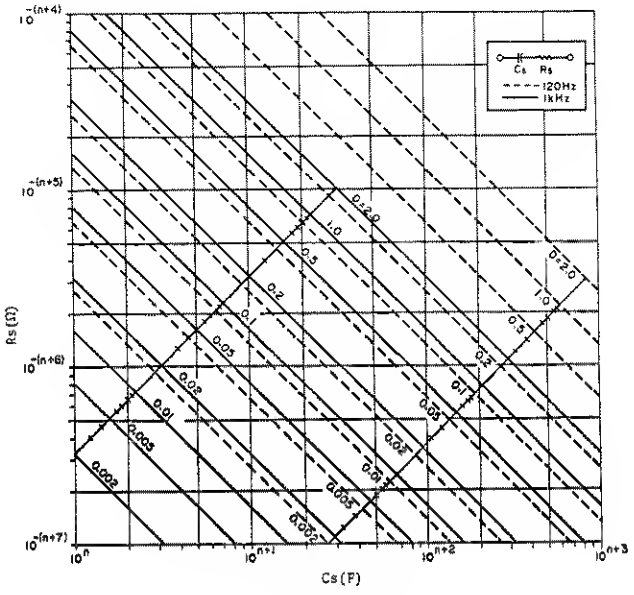
Parallel Inductance - Parallel Resistance
(A)



Series Inductance - Series Resistance
(B)



Parallel Capacitance - Parallel Resistance
(C)



Series Capacitance - Series Resistance
(D)

When n represents a free integer.

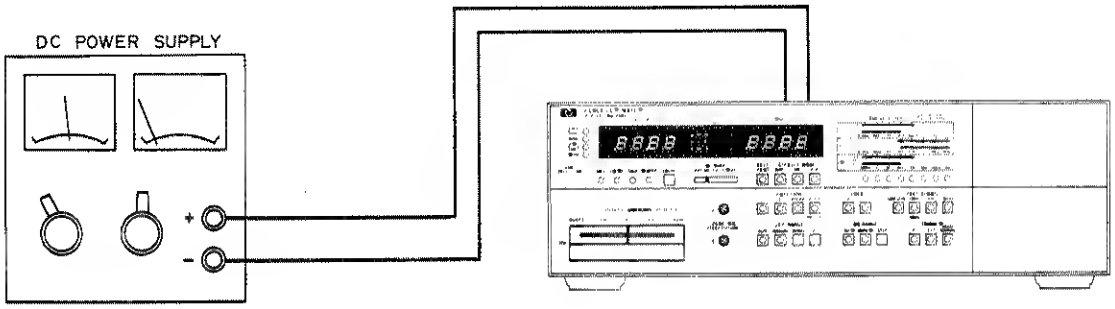
To obtain the graph for 10kHz test frequency, add 1 to n on resistance scales.

Figure 3-6. Relationship of Dissipation to Series and Parallel Resistance.

Table 3-3. Annunciation Display Meanings.

DISPLAY LCR / DQ	Indicated Condition	Action
	FUNCTION has been inappropriately set.	Change 4262A FUNCTION to L, C or R suitable for the sample being measured.
	Measured L or C value exceeds 1999 counts. DQ display indicates that DQ measurement has been omitted.	Set 4262A to: CIRCUIT MODE: AUTO LCR RANGE: AUTO
	Measured R value exceeds 1999 counts.	Try changing TEST SIGNAL to 120, 1k or 10kHz.
 (any LCR reading) (overflowed)	Measured D/Q value exceeds the upper range limit (1999 counts). Accuracy of LCR readings may not be within specifications.	Set 4262A DQ RANGE to AUTO. Try changing TEST SIGNAL to 120, 1k or 10kHz.
	CIRCUIT MODE setting is not suitable for the sample being measured.	Set 4262A to: CIRCUIT MODE: AUTO LCR RANGE: AUTO
	Measured L, C or R value is extremely large or small compared with the selected range.	Try changing TEST SIGNAL to 120, 1k or 10kHz.
 (less than 80 counts)	When Measured L or C value is less than 80 counts, DQ measurement is omitted.	Set 4262A LCR RANGE to AUTO. Try changing TEST SIGNAL to 120, 1k or 10kHz.
 (any DQ reading)	In △LCR measurement, the difference between the preset value and the measured value of the sample exceeds -999 counts.	———
	In △LCR measurement, the calculated difference exceeds -999 counts. In addition, the value of measured sample is less than 80 counts.	———
Minus (-) is displayed.	Minus display sometimes occurs when sample having a value around zero is measured.	Zero count display is meaningful when minus (-) display repeatedly turns on and off.
	Sometimes a minus display occurs when a capacitor (or inductor) is measured in L (or C) FUNCTION.	Change to appropriate FUNCTION.
	Offset adjustment signal applied is too great (causes minus display).	Readjust offset signal for proper magnitude.

MEASUREMENT PROCEDURE FOR GENERAL COMPONENTS



1. Remove shorting bar connections between high terminals and between low terminals (all terminals are now isolated from each other). Connect 16061A Test Fixture to 4262A UNKNOWN terminals.

Note

User constructed test fixture may also be connected. Guard terminal is sometimes used in small capacitance measurements.

2. Depress LINE button to turn instrument on. An initial display test is automatically performed before measurement begins.

3. Check that 4262A trigger lamp begins to flash. The 4262A control functions are automatically set as follows (automatic initial settings):

DC BIAS . . . . . OFF
SELF TEST . . . . . OFF
CIRCUIT MODE . . . . . AUTO
FUNCTION C
LCR RANGE . . . . . AUTO
LOSS . . . . . D
DQ RANGE . . . . . AUTO
TEST SIGNAL 1kHz
TRIGGER . . . . . INT

Note

To check fundamental operating conditions of the instrument, perform SELF TEST (refer to Paragraph 3-5 for SELF TEST details). Press SELF TEST button again to release the function.

4. Rotate C ZERO ADJ control until capacitance readout is 000 counts on LCR DISPLAY (minus sign should not appear).

5. Connect a shorting lead to Test Fixture to short-circuit the Unknown terminals to zero ohms (zero microhenries).

6. Press L FUNCTION button.

Figure 3-7. General Component Measurements (Sheet 1 of 3).

7. Rotate L ZERO ADJ control until inductance readout is 000 counts on LCR DISPLAY.

Note

To achieve more critical zero adjustments, when 10kHz test signal frequency is used, perform the capacitance and inductance zero offset adjustments (steps 4, 5, 6 and 7) at 10kHz.

8. Remove shorting lead from 16061A.

9. Select desired FUNCTION, either L, C or R/ESR.

10. Connect sample to be measured (L, C or R) to Test Fixture.

11. Model 4262A will automatically display value of unknown.

Note

If O-F, U-CL, minus (-) or blank display occurs, see Table 3-3 for solution. Measured values for semiconductor devices are sometimes unreliable when TEST SIGNAL LOW LEVEL pushbutton is in its normal (1V) state (button lamp is not lit). In these instances, follow Figure 3-8 for semiconductor device measurement.

Note

If manual triggering is required, press HOLD/MANUAL button. Each time the button is pressed, the instrument is triggered.

12. If internal DC bias is required, set DC BIAS switch to 1.5V, 2.2V or 6V: If not, OFF position should be selected.

Note

DC bias application may only be used for capacitance measurements.

CAUTION

POSITIVE POLE OF ELECTROLYTIC CAPACITOR MUST BE CONNECTED TO HIGH TERMINALS AS PLUS BIAS VOLTAGE IS APPLIED TO HIGH TERMINALS WITH RESPECT TO LOW TERMINALS.

Note

An external bias voltage up to +40V may be applied to EXT DC BIAS rear panel connector. Connect DC power supply to EXT DC BIAS connector. Set DC BIAS switch to EXT.

CAUTION

EXTERNAL DC BIAS AT EXT BIAS CONNECTOR MUST NEVER EXCEED +40V.

13. Read measured value on display.

Note

It is usually recommended that the LCR RANGE be set to MANUAL and to hold the range when measuring multiple samples having almost the same value. Range hold operation will somewhat shorten measurement time.

Note

Series resistance of electrolytic capacitors, inductors or transformers can be measured in series R/ESR measurement mode. In these cases, the number of digits is sometimes reduced. On the other hand, resistance can, of course, be indirectly measured with the C/L FUNCTION and calculated from one of the following equations:

$$Rs = D/\omega Cs \text{ (Cs-D measurement)}$$
$$Rs = \omega Ls \cdot D \text{ (Ls-D measurement)}$$
$$Rs = \omega Lp \cdot \frac{D}{1 + D^2} \text{ (Lp-D measurement)}$$

The above relationships are graphically shown in Figure 3-6.

CAUTION

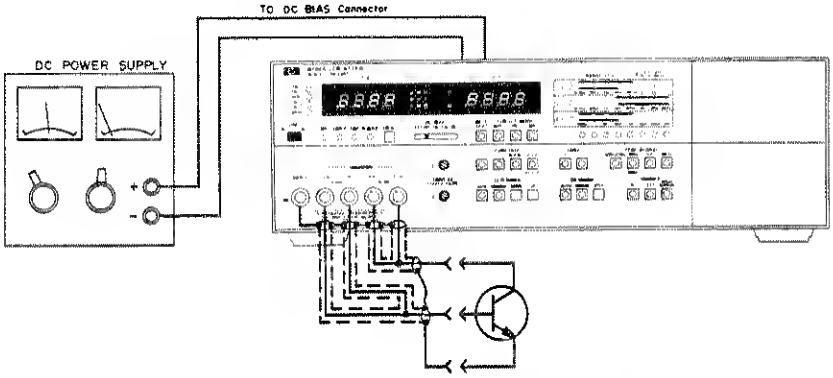
DO NOT CONNECT A CHARGED CAPACITOR (EXCEEDING 40V) DIRECTLY TO THE UNKNOWN TERMINALS AS A DUT.

CAUTION

NEVER APPLY A DC VOLTAGE DIRECTLY BETWEEN THE UNKNOWN H AND L TERMINALS WITHOUT PROPER PROTECTION AGAINST A POSSIBLE HARMFUL CURRENT. DC VOLTAGE MUST NOT BE APPLIED TO THE L TERMINAL WITH RESPECT TO GROUND.

Figure 3-7. General Component Measurements (Sheet 3 of 3).

Junction Capacitance Measurement



Setup-

The figure above is a typical test setup used for measuring base-collector junction capacitance (Cob) of an NPN transistor. For this measurement, test leads or fixture may be user designed. If external DC bias is not necessary, arrangement and procedures associated with this function may be deleted from setup.

Procedure-

1. Press LINE button to turn instrument on. After the initial display test, trigger lamp will begin to flash and the 4262A functions are automatically set as follows:

SELF TEST	OFF
CIRCUIT MODE	AUTO
FUNCTION	C
LCR RANGE	AUTO
LOSS	D
DQ RANGE	AUTO
TEST SIGNAL	1kHz
TRIGGER	INT

2. Press TEST SIGNAL LOW LEVEL and PRL CIRCUIT MODE buttons. The test signal level is now 50mV and the parallel equivalent circuit mode is selected.

Note

A semiconductor junction capacitance measurement must be made with a low level test signal. If desired, TEST SIGNAL fequency may be set to 10kHz.

3. Adjust C ZERO ADJ control for zero counts on LCR DISPLAY.

Note

If necessary, apply DC bias voltage internally or externally at rear panel EXT DC BIAS connector. External DC bias source should be stable with low noise. Set DC BIAS switch in EXT position during application of external DC bias.

Figure 3-8. Semiconductor Device Measurement (Sheet 1 of 2).

CAUTION

NEVER APPLY AN EXTERNAL DC BIAS OVER +40V.

4. Connect Semiconductor device to test lead or to fixture. To obtain reliable measurement results, observe the following:

Note

a. It is impossible to measure junction capacitance when bias current flows through sample.

b. If lead length of device allows, it is recommended that the device be connected directly to UNKNOWN terminals.

5. Read displayed values. Loss factor of the sample will be simultaneously displayed on DQ DISPLAY.

Note

When using manual trigger, press HOLD/MANUAL button. Each time the button is pressed, the instrument is triggered. When measuring multiple samples whose values are about the same, it is recommended that the LCR RANGE be set to MANUAL and that the range be held.

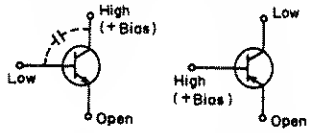
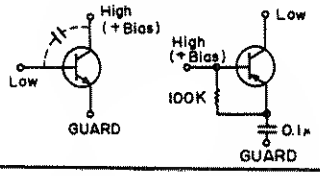
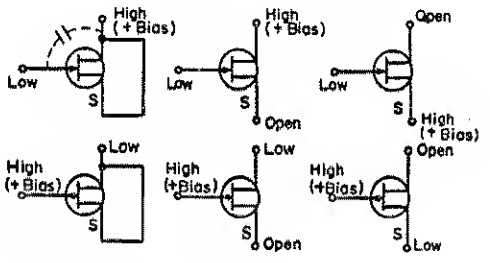
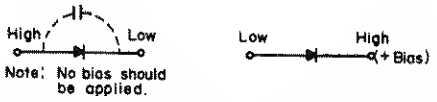
Parameter Measured	Connections to 4262A
Base-collector junction capacitance (Cob)- Emitter current = 0	
Base- collector junction capacitance (Cre)- Common emitter	
FET gate capacitance	
Diode junction capacitance Note: Hot carrier diodes and germanium diodes sometimes cannot be measured.	

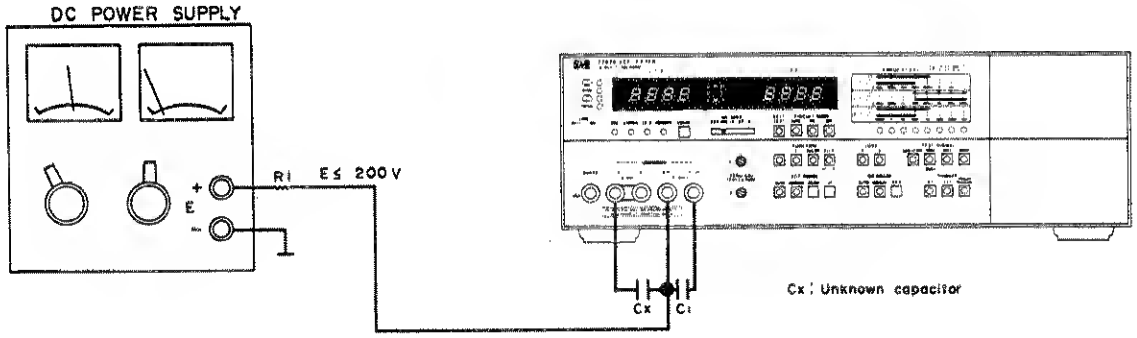
Figure 3-8. Semiconductor Device Measurement (Sheet 2 of 2).

External DC Voltage Bias Circuits (40V < , < 200V)

1. Connect external dc bias source as shown in diagram.

CAUTION

DO NOT APPLY DC VOLTAGE EXCEEDING 200VOLTS OR 4262A CIRCUITRY WILL BE DAMAGED.



Note

+E voltage is applied to Cx in figure. -E voltage can be applied to Cx in this figure. In the above arrangement, the polarity of Cx and C1 must be taken into consideration.

CATUION

NEVER SHORT BETWEEN HPOT AND LOW TERMINALS WHEN R1 IS SMALLER THAN 1kΩ. MAKE SURE THAT UNKNOWN CAPACITOR IS NOT DEFECTIVE BEFORE CONNECTING TO INSTURMENT.

TO AVOID HARMFUL SURGE CURRENT WHICH MAY FLOW THROUGH INTERNAL CIRCUITRY WHEN A HIGH VOLTAGE DC BIAS IS SUDDENLY APPLIED, IT IS RECOMMENDED THAT DC BIAS BE GRADUALLY INCREASED FROM A LOWER VOLTAGE.

Note

Ripple or noise of external dc bias source should be as low as possible. The low frequency noise of bias source should be less than 1mVrms for a TEST SIGNAL level of 50mV (LOW LEVEL) and 30mVrms for 1V.

Figure 3-9. External DC Bias Circuit (Sheet 1 of 3).

2. Minimum values for both C1 (dc blocking capacitor) and R1 are given in table below:

Note

Insulation resistance for Cx must be greater than a certain minimum value. Refer to Table 3-4 for unusual operating indications.

Range (at 120Hz)	1000pF	10.00nF	100.0nF	1000nF	10.00μF
Minimum C1	0.01μF	0.1μF	1μF	10μF	10.00μF
Minimum R1	300kΩ	100kΩ	10kΩ	1kΩ	100Ω

In 1kHz(10kHz) measurement, multiply both range value and value of C1 by 1/10 (1/100). If the calculated value of C1 is less than 0.01μF, use 0.01μF capacitor.

Note

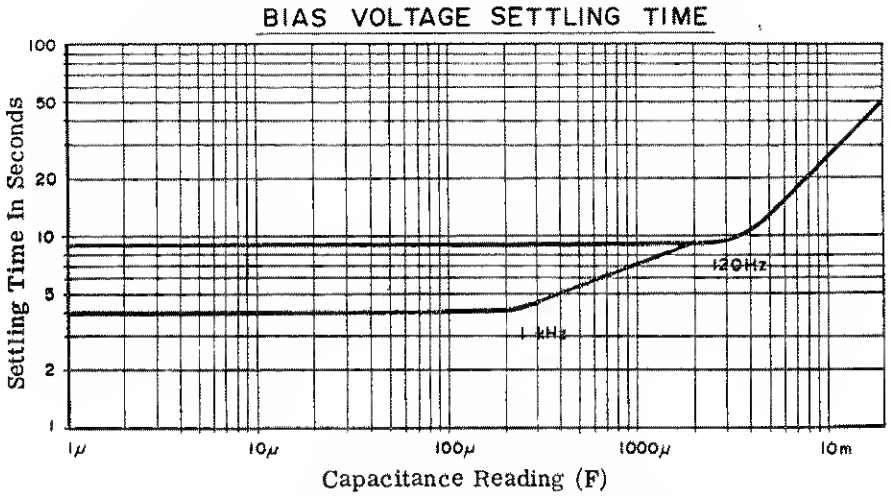
DC withstand voltage for C1 capacitor must be greater than dc applied voltage E. Also observe polarity of capacitor C1 with respect to applied voltage.

3. Set 4262A controls as follows:

SELF TEST. . . . . .OFF
FUNCTION. C
CIRCUIT MODE. . . . . .PRL
Other controls. . . . . .any setting

4. Read displayed value after allowing time for bias voltage to settle. Typical settling times are:

120Hz: 6 to 7 seconds.
1kHz/10kHz: 2 to 3 seconds.



If C1 and R1 which are larger than those given in table on above are connected, longer settling times are necessary.

Figure 3-9. External DC Bias Circuit (Sheet 2 of 3).

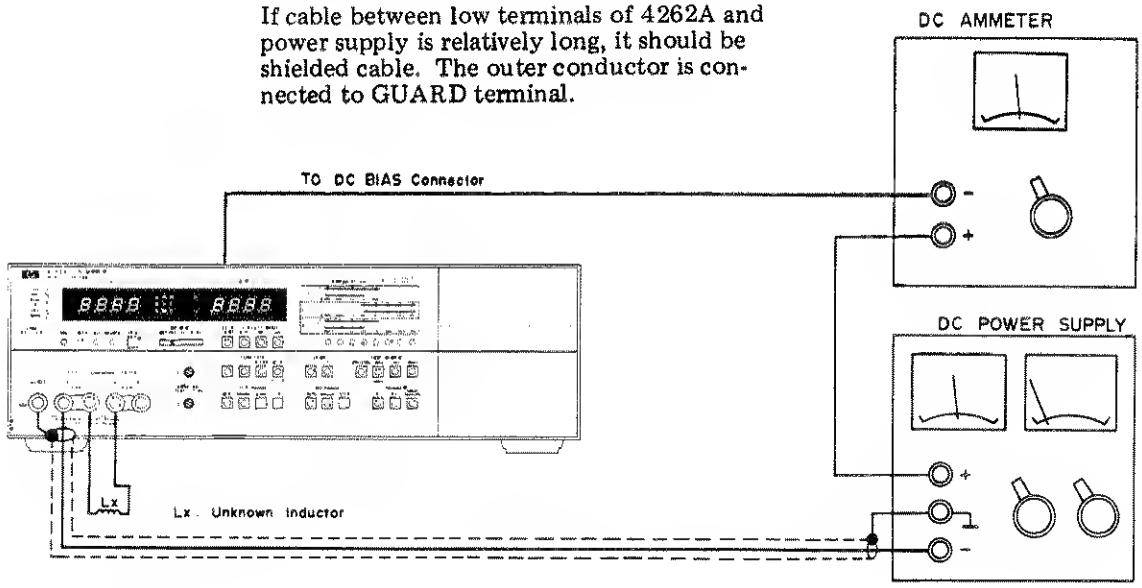
Using Current Bias (for inductors).

1. Connect dc power supply as shown below:

Note

DC power supply should be floated from ground.

If cable between low terminals of 4262A and power supply is relatively long, it should be shielded cable. The outer conductor is connected to GUARD terminal.



2. Set 4262A controls as follows:

DC BIAS . . . . . EXT
FUNCTION. L
CIRCUIT MODE. . . . . PRL or SER
LCR RANGE . . . . . MANUAL
Other controls. . . . . any settings

Note

First, determine appropriate range by connecting sample with no dc bias current applied. Then hold the range.

3. Recommended inductance ranges and maximum bias currents are:

Range (at 120Hz)	1000 μH	10.00 mH	100.0 mH	1000 mH	10.00 H	100.0 H
CIRCUIT MODE	SER			PARA		
Maximum Bias Current	40mA	36mA	13mA	40mA	36mA	13mA

In 1kHz(10kHz) measurement, multiply range value by 1/10 (1/100).

CAUTION

DC BIAS OVER +40 VOLTS MUST NOT BE APPLIED TO EXTERNAL DC BIAS INPUT CONNECTOR.

Figure 3-9. External DC Bias Circuit (Sheet 3 of 3).

Table 3-4. Unusual Operating Indications (Sheet 1 of 4).

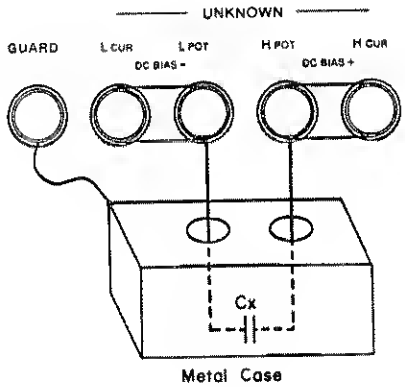
Indication:	Cause of trouble:
A. Same sample sometimes shows quite different values between PRL and SER CIRCUIT MODE measurements. B. The decimal point moves and measurement unit changes.	A and/or B may occur in the following cases: Resistance of low loss inductor or capacitor being measured in R FUNCTION. Inductance of lossy inductor or capacitance of lossy capacitor being measured in L or C FUNCTION.

What to do:

A. Do not set CIRCUIT MODE to AUTO. Set CIRCUIT MODE to a PRL or SER setting that shows a valid display.

B. Set LCR RANGE to MANUAL. Manually settle the instrument on an appropriate range.

Indication:	Cause of trouble:
The displayed value fluctuates on minimum capacitance, maximum inductance or maximum resistance ranges in either PRL or SER circuit modes.	Here are some of the reasons why this happens: A. A large size sample is being measured. B. A high voltage power line or similar exists near the 4262A. C. The 4262A and sample are connected together with relatively long, non-shielded cable.



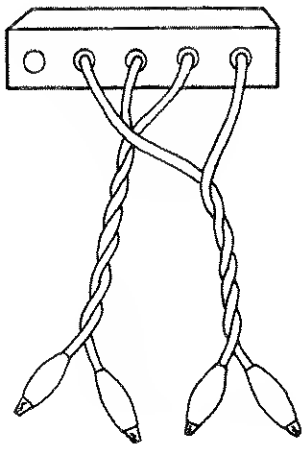
What to do:

1. Enclose sample in metal case. Connect case electrically to 4262A GUARD terminal as illustrated.

2. Use shielded cable for connection between sample and the instrument. Connect cable shield to GUARD.

Table 3-4. Unusual Operating Indications (Sheet 2 of 4).

Indication:	Cause of trouble:
When measuring a low impedance (small inductance, resistance or high capacitance), measurement error is excessive.	1. Excessive residual impedance (inductance, capacitance or resistance) of test leads in a two terminal measurement. 2. Mutual test lead induction between current leads (H_{CUR} and L_{CUR}) and potential leads (H_{POT} and L_{POT}).



What to do:

Use test leads in four-terminal configuration and measure.

Twist current leads (H_{CUR} and L_{CUR}) together. Do the same with potential leads (H_{POT} and L_{POT}).

Additional error is presented as $\omega^2 LrCx \times 100$ (%) for C measurement, where:

$\omega = 2\pi f$
f = test frequency
Lr = residual inductance
Cx = unknown capacitance

Indication:	Cause of trouble:	
	Measurement	Cause of error
Measurement error is excessive when high impedance (high inductance, small capacitance) is measured.	High Inductance	Stray capacitance between High and Low leads.
	Small Capacitance	Stray capacitance between High and Low leads.

What to do:

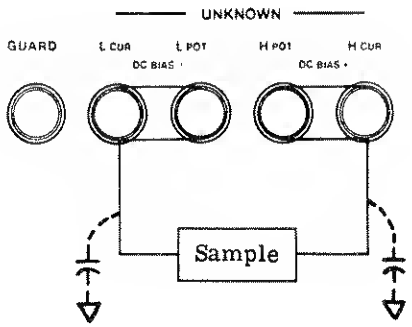
Use shielded cable for connection between sample and 4262A UNKNOWN terminals. Connect outer conductor to GUARD terminal.

Adjust C ZERO ADJ control properly to compensate for stray capacitance.

Table 3-4. Unusual Operating Indications (Sheet 3 of 4).

Indication:	Cause of trouble:
Excessive measurement error.	Cause A . Effect of Low terminal capacitance with respect to ground. Sometimes the measurement can not be performed when a relatively large capacitance between L_{POT} terminal and ground exists. Allowable magnitudes for stray capacitance without additional error are given in figure at left. Cause B . Effect of High terminal capacitance with respect to ground. The stray capacitance will reduce test signal level applied to the sample measured during capacitance measurement. This decrease in signal level will not produce an additional error even when measurement signal level is reduced to a third of its nominal level. It is neccessary, of course, that special care be taken to use the proper test signal level when a device is measured whose parameters may be affected by the test signal level. Display fluctuations may sometimes appear.

Measurement Frequency	Allowable Stray Capacitance Magnitude
120Hz	100nF
1kHz	1000pF
10kHz	200pF



Indication:	What to do:
Internal resistance of a battery can not be measured.	1. Connect sample battery (observe polarity) as illustrated. 2. Batteries up to 40V are measured under no load conditions. 3. If battery voltage exceeds 4V, set DC BIAS to EXT 4. Since the internal resistance of a battery is relatively low, use the four-terminal measurement configuration.

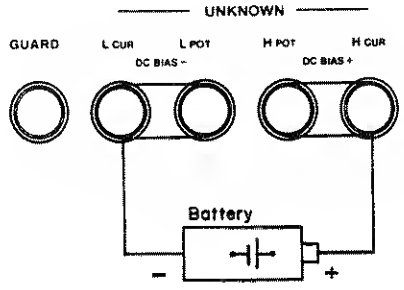


Table 3-4. Unusual Operating Indications (Sheet 4 of 4).

Indication:	Cause of trouble:
When a sample (for example, an iron core inductor) is measured in AUTO of CIRCUIT MODE, the instrument repeats range selection and does not complete the measurement depending upon level of test current used.	The measurement reading of sample depends on the level of measurement test signal applied.

What to do:
Set LCR RANGE to MANUAL. Manually settle the instrument on an appropriate range.

Indication:	
When a capacitor is measured with dc bias voltage applied, an abnormal display occurs.	There are limitations to the permissible insulation resistance of a capacitor measured with dc bias. See table below.

MODE		RANGE				
1kHz	Cp	100.0pF	1000pF	10.00nF	100.0nF	1000nF
	Cs	100.0nF	1000nF	10.00μF	100.0μF	1000μF
Permissible insulation resistance (Ri)		30MΩ	3000kΩ	300kΩ	30kΩ	3000Ω

Note

In 120Hz(10kHz) measurement, multiply range value by 10(1/10).

Ri given in above table is applicable for a dc bias of 40 V. When the bias voltage is less than 40V, Ri limit is RiVb/40 (Ω) where Ri is value given in the table and Vb is applied dc bias voltage.

3-40. OPTION OPERATION.

3-41. Operating instructions for Options 001, 004, and 101 are described in the following paragraphs.

3-42. OPTION 001: BCD PARALLEL DATA OUTPUT.

3-42. The 4262A Option 001 provides parallel BCD outputs for LCR display, D/Q display and information for various control settings. These outputs are fed to two 50 pin connectors on the rear panel.

3-44. Output Data and Pin Assignment.

3-45. The 4262A Option 001 provides eight kinds of output data:

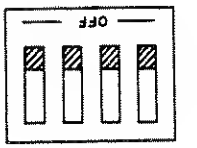
(1) FUNCTION and CIRCUIT MODE.
(2) Test Signal Frequency (LOW LEVEL or normal is excluded).
(3) Annunciator: Normal, Overflow, Uncal, (LCR and D/Q are not annunciated).
(4) Unit: p, n, μ, m, k, M, D, Q (judgement whether capacitance, inductance or resistance depends on output of FUNCTION switch setting information).
(5) Decimal Point.
(6) Polarity.
(7) Displayed value.
(8) Other Input/Output Signals.

The signal pin assignments for the 50 pin connector are shown in Figure 3-40. When these signals are fed to digital printer, the print-out is given as a 10 digit decimal number.

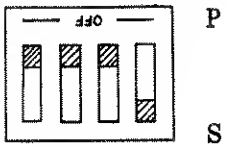
3-46. Alternate Output of LCR and D/Q Data.

BCD outputs for LCR and D/Q data of 4262A Option 001 can be alternately supplied through one 50 pin BCD LCR DATA OUTPUT connector on rear panel. This alternate output is enabled by changing slide switch setting on printed circuit board P/N 04262-66535. PC board 04262-66535 is located nearest to the rear panel in the right hand row of PC boards. Normal setting of the four section slide switch for parallel output and the setting for alternate output are illustrated below.

Normal
Parallel output:



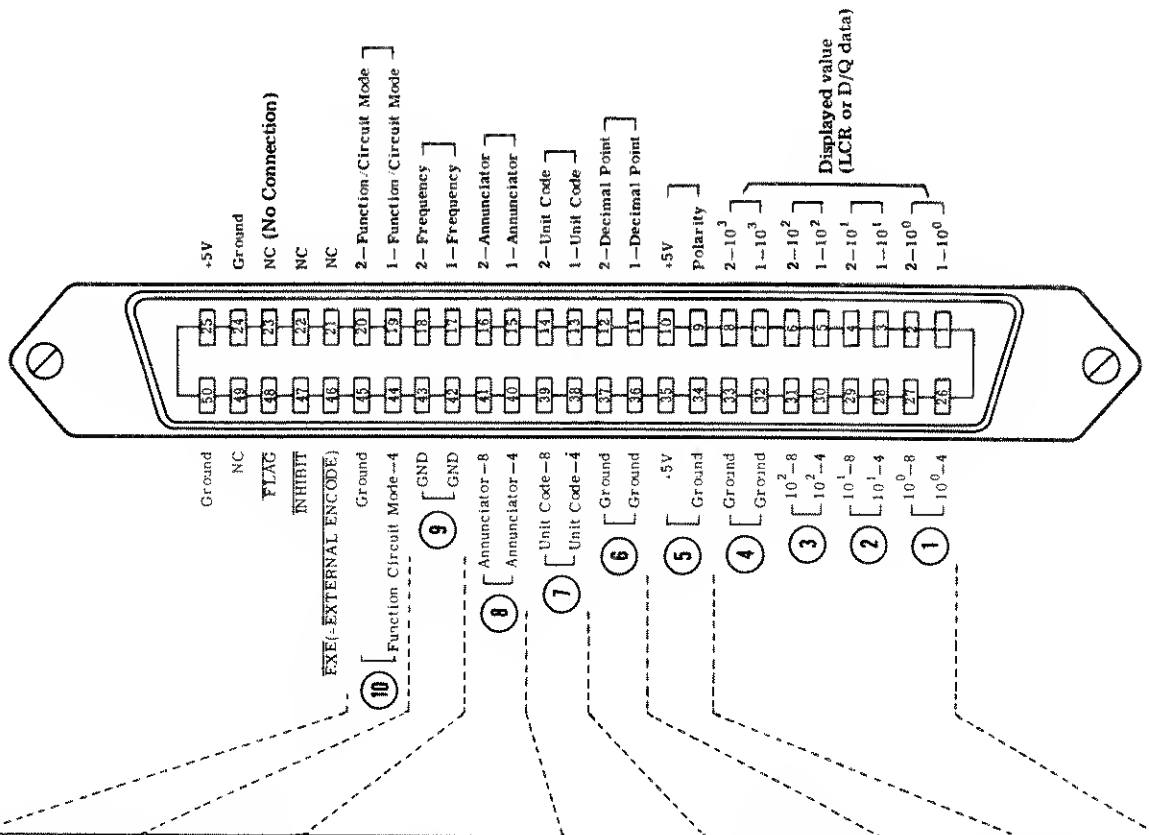
Alternate output:



3-47. Output Timing.

3-48. Timing charts for parallel (simultaneous) output and alternate output are shown in Figure 3-41.

Note: Figure in circle indicates column number.

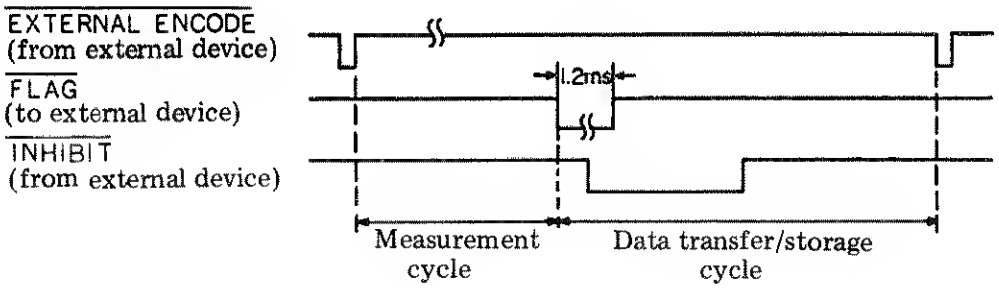


FUNCTION CIRCUIT MODE		FREQUENCY		ANNUNCIATOR		UNIT		DECIMAL POINT		POLARITY		DATA	
4262A	Printed letter	4262A	Printed letter	4262A	Printed letter	4262A	Printed letter	4262A	Printed letter	4262A	Printed letter	4262A	Printed letter
C PRL	0	120 Hz	0	(NORMAL)**	0	p	0	XXXX.	0	+ (blank)	+	0	0
C SER	1	1 kHz	1	Ω—F	1	n	1	XXX.X	1			1	1
L PRL	2	10 kHz	2	μ—CL	2	μ	2	XX.XX	2	—	—	2	2
L SER	3			(LCR NOT AV)**	3	m	3	X.XXX	3			3	3
R PRL	4			(DQ NOT AV)**	4	—	4					4	4
R SER	5					k	5					5	5
						M	6					6	6
						D	7					7	7
						Q	8					8	8
												9	9

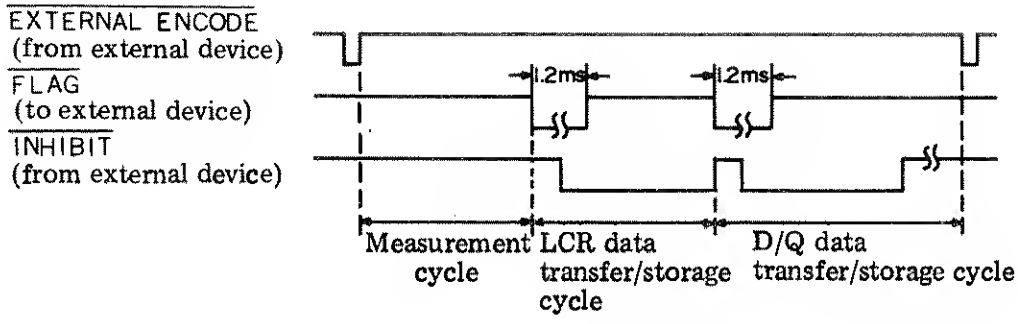
* When annunciation is other than NORMAL, printed number for DATA is 2000.
** These are not displayed.

Figure 3-40. Pin Assignments of Output Connector and Output Format.

Parallel output:



Alternate output:



NOTE

Assert /INHIBIT while /FLAG is asserted. The BCD output will be maintained until /INHIBIT goes HIGH.

Figure 3-41. Timing Chart of BCD Data Output.

3-49. OPTION 004- COMPARATOR.

3-50. The 4262A Option 004 (shown in Figure 3-43) provides:

(a) HIGH and LOW limits setting for comparison of LCR and D/Q measured data.

(b) LED visual decision output lamps display of results of HIGH and LOW limit comparisons.

(c) TTL outputs and relay outputs for HIGH, IN, and LOW decision outputs.

3-51. Front Panel Features (Figure 3-42).

(1) LCR LIMIT Switch: Two four-digit switches provide HIGH and LOW limit values with which measured LCR value is compared. Setting range is from 0000 to 1999.

(2) LCR Decision Output Lamp: Results of comparison are indicated by LED lamps as follows:

HIGH: (measured value $\geq$ High limit)
IN: (Low limit $\leq$ measured value $<$ High limit)
LOW: (measured value $<$ Low limit)

(3) LCR LIMIT CHECK Switch: While this switch is depressed, HIGH and LOW limit values set by LCR LIMIT switches (1) are displayed in LCR and D/Q displays. During this period, three LCR decision output lamps are lit. Comparator must be enabled display limits.

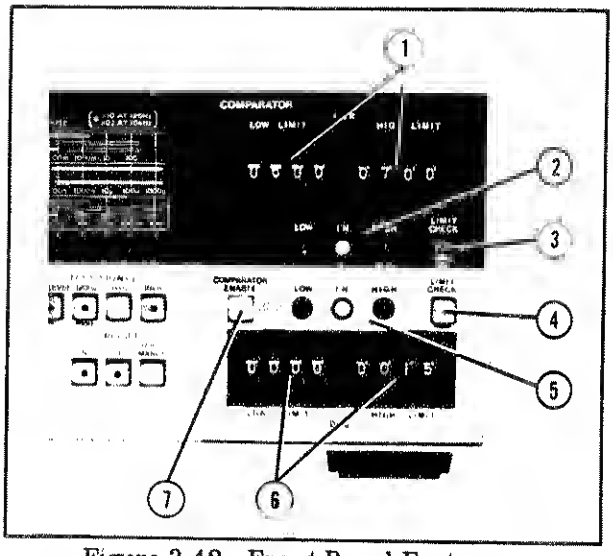


Figure 3-42. Front Panel Features

(4) D/Q LIMIT CHECK Switch: While this switch is depressed, HIGH and LOW limit values set by D/Q LIMIT switches (6) are displayed in LCR and D/Q displays. During this period, three D/Q lamps of decision outputs are lit.

(5) D/Q Decision Output Lamp: Results of comparison is indicated by LED lamps as follows:

HIGH:(measured value $\geq$ High limit)
IN: (Low limit $\leq$ measured value $<$ High limit)
LOW: (measured value $<$ Low limit)

(6) D/Q LIMIT Switch: Two four-digit switches provide HIGH and LOW limit values with which measured D/Q value is compared. Setting range is from 0000 to 1999.

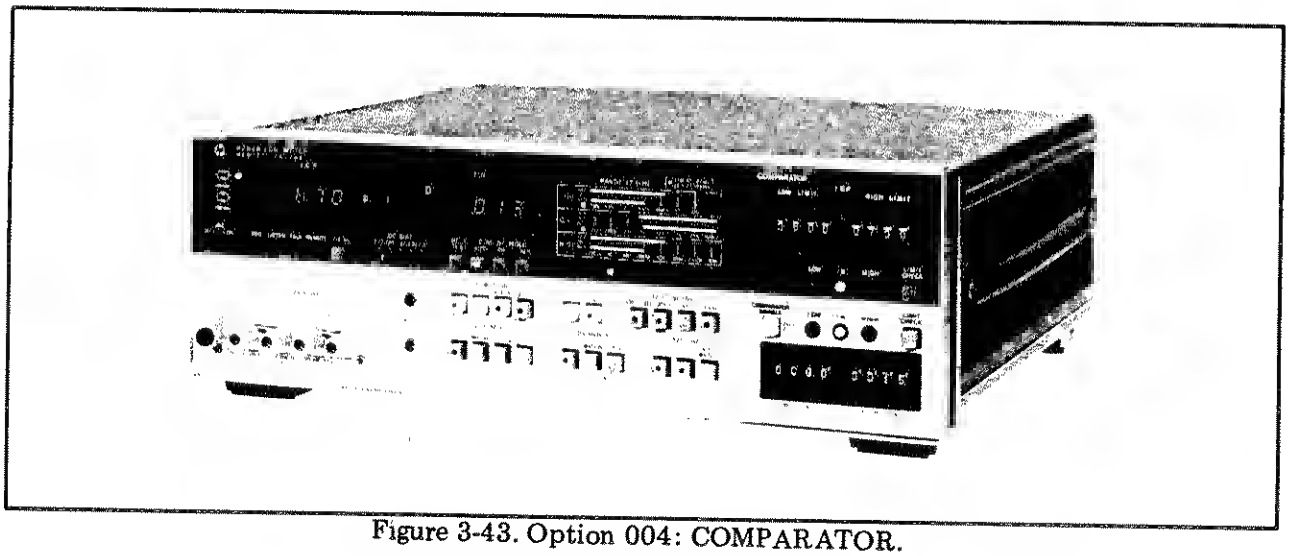


Figure 3-43. Option 004: COMPARATOR.

(7) COMPARATOR ENABLE Switch: This switch enables the Option 004 to compare measured data with HIGH and LOW limits under a fixed range condition (LCR or D/Q RANGE switch set to MANUAL). If LCR RANGE switch or D/Q switch is set to AUTO, depressing COMPARATOR ENABLE switch changes LCR or D/Q RANGE switch setting to MANUAL.
If AUTO key of LCR or D/Q RANGE switch is depressed while COMPARATOR ENABLE switch is ON, one measurement cycle is done in AUTO ranging and the range is fixed to that selected in this measurement cycle.

3-52. LIMIT Setting Warning: If HIGH LIMIT setting is lower than LOW LIMIT setting, HIGH and LOW lamps of decision output repeatedly turn ON and OFF to warn operator to change LIMIT setting.

3-53. DATA OUTPUT Connector Decision Output: Decision outputs in TTL open collector signal and in relay contact are supplied through COMPARATOR OUTPUT connector on the rear panel. Signal pin assignment is given in Figure 3-44.

WARNING !

DO NOT APPLY AC LINE VOLTAGE TO RELAY OUTPUT CONNECTOR PIN TO SWITCH LINE CURRENT. For such relay applications, remotely control an external relay with relay output.

Relay Contact Ratings

	AC	DC
Contact Resistance	100mΩ	100mΩ
Maximum Permissible Power	30VA	20W
Maximum Permissible Voltage	110V	30V
Maximum Permissible Current	0.3A	1A
Actuation Life	> 10 million	> 1 million

Decision Output Data Format

Decisions	Relay output pins			TTL output pins		
	DQ LCR 13 17	DQ LCR 14 18	DQ LCR 39 43	DQ LCR 15 19	DQ LCR 16 20	DQ LCR 41 45
HI	S	O	O	H	L	L
IN	O	O	S	L	L	H
LO	O	S	O	L	H	L

S: Short O: Open
Referenced to common (pin 38 or 42).
TTL Output sink current: 30mA max.

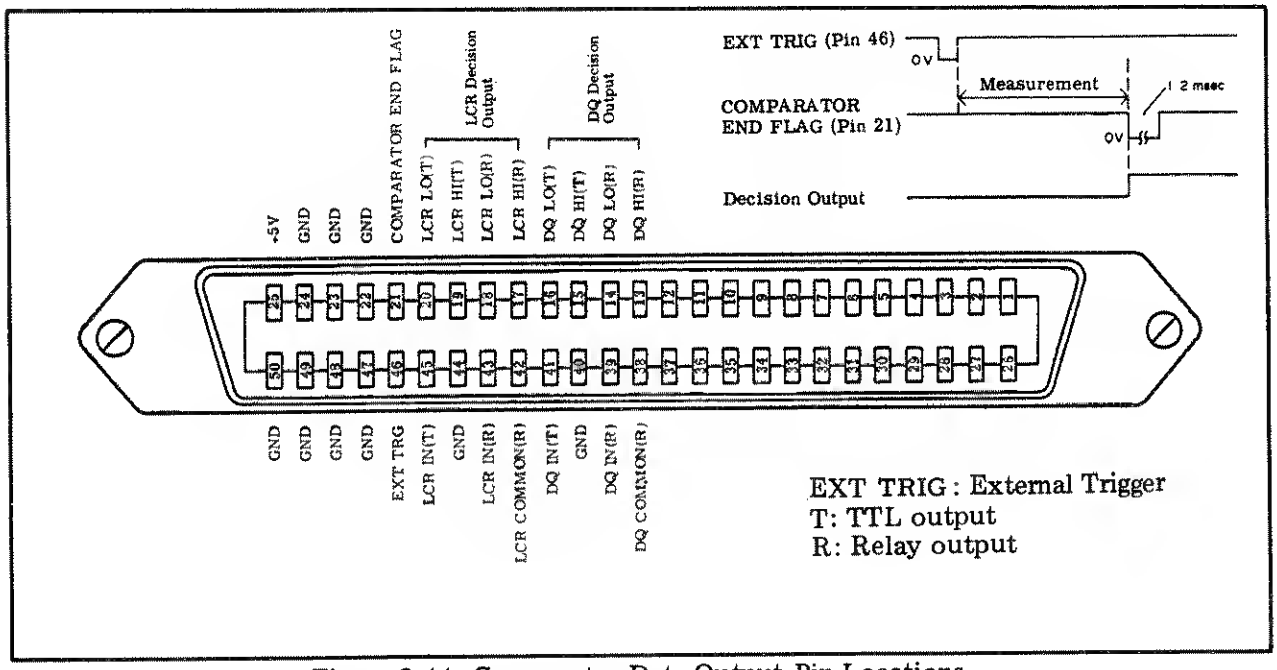


Figure 3-44. Comparator Data Output Pin Locations.

3-60. OPTION 101: HP-IB.

3-61. The 4262A Option 101 provides interface capabilities in accordance with IEEE-STD-488-1975 recommendations.

3-62. Connection to HP-IB Controller: The 4262A Option 101 can be connected to an HP-IB Controller (HP calculator) via HP-IB digital bus connector on the rear panel of the 4262A and the bus connector of the Bus I/O card installed in calculator.

3-63. HP-IB Status Indicator: The four LED lamps of the HP-IB Status Indicator (located below the LCR display) show which HP-IB condition the 4262A is in:

SRQ: SRQ signal put on HP-IB line from 4262A. See paragraph 3-70 for details.
LISTEN: 4262A is set to listen. See paragrapb 3-69 for details.
TALK: The 4262A is set to talk. See paragraph 3-67 for details.
Remote: The 4262A is remotely controlled. See paragraph 3-71 for details.

3-64. LOCAL Switch: This switch disables remote control and enables setting measurement conditions by front panel controls (pushbutton switches). REMOTE lamp of HP-IB status indicator turns off when LOCAL switch is depressed. (When Local Lock Out does not function).

3-65. HP-IB INTERFACE CAPABILITIES: The 4262A Opt 101 has the following eight bus interface functions:

SH1: Source Handshake Capability.
AH1: Acceptor Handshake Capability.
T5: Talker (the 4262A sends measurement data to the bus).
L4: Listener (the 4262A receives remote control signals from the bus).
SR1: Service Request Capability.
RL1: Remote/Local Capability.
DC1: Device Clear Capability.
DT1: Devico Trigger Capability.

3-66. Source and Acceptor Handshake: SH1, AH1.

Three Bus handshake lines (DAV, NRFD and NDAC) perform Source and/or Acceptor handshake functions.

(1) DAV (DAta Valid). DIO (Data Input Output) line is available.
(2) NRFD (Not Ready For Data). Listener preparation for receiving data from Talker is not yet completed.
(3) NDAC (Not Data Accepted). Listener has not yet received data from Talker.

3-67. Talker Capability: T5.

When set to Talker by MTA (My Talk Address) signal from controller, the 4262A sends measurement data to the Bus in one of three types of output formats:

Type A: Ordinary output format. Address switch on the rear panel set to FMT A.

S (1) FC (2) F (3) -NN.NNE-NN (4) , S (5)(1) F (6) N.NNN (7) CRLF (8)

Type B: Output format used for Model 5150A HP-IB Digital Recorder. Address switch on the rear panel set to FMT B.

S (1) FC (2) F (3) -NN.NNE-NN (4) CRLF (8) S (1) F (6) N.NNN (7) CRLF (8)

Type C: Output format used in resistance measurement or LCR ONLY measurement when no D/Q data is to be outputted. Selection of this format is automatically done in accordance with FUNCTION switch setting.

S (1) FC (2) F (3) -NN.NNE-NN (4) CRLF (8)

The numbered elements of output data are described below:

(1) Status:

N. . . . . .Normal
O. . . . . Overflow
U. . . . . Uncal
X. . . . . .LCRNA or DNA
(NA: Not Available)

(2) Function and Circuit Mode:

FUNCTION	MEASUREMENT	CIRCUIT MODE
CP	C	PRL
CS	C	SER
LP	L	PRL
LS	L	SER
RP	R	PRL
RS	R/ESR	SER

(3) Frequency:

A. 120Hz (100Hz)
B. 1kHz
C. 10kHz

(4) LCR Data
(5) Data Delimiter
(6) Loss

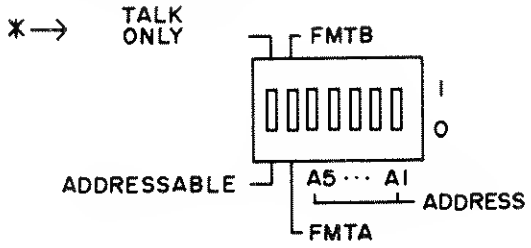
D. . . . . Dissipation Factor measurement
Q. . . . . Quality Factor measurement

(7) DQ Data
(8) Data Terminator

3-68. Functions Related to Talker Capability.

EOI (End Or Identify): When multiple byte data of Source Handshake has been sent, the 4262A provides EOI to the bus.

Talk Only Mode: When ADDRESS switch is set to TALK ONLY "1" position, the 4262A is set to Talker regardless of address code.



Talk Address Disabled by Listen Address: MTA (My Talk Address) is automatically disabled when MLA (My Listen Address) is set. MTA (My Talk Address) is otherwise disabled by IFC (Interface Clear) signal, OTA (Other Talk Address) signal or UTA (Untalk Address) signal.

3-69. Listener Capability: L4.

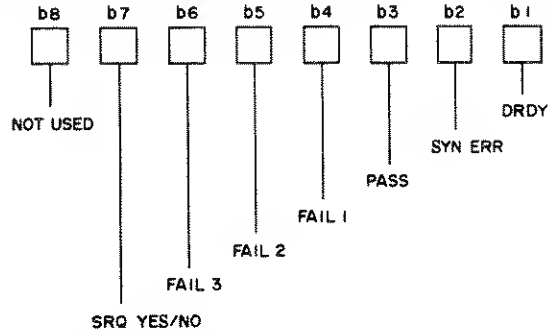
To receive Remote Program signal or Addressed Command signal, the 4262A is set to Listener by an MLA (My Listen Address) signal from the bus.

(1) Remote Program signal: Remote program codes for the 4262A are listed in Table 3-60.
(2) Addressed Command signal: When the 4262A receives command signals GET, GTL, or SDC, it is set to Listener and controlled by command signals. These command signals are valid regardless of the status (remote or local).
GET (Group Execute Trigger): When the 4262A receives this command, it is triggered regardless of front panel TRIGGER switch setting.
GTL (Go to Local). The 4262A is set to LOCAL by this command to enable front panel control.
SDC (Selected Device Clear): When this command is accepted, front panel controls are set to initial conditions (the same conditions that are automatically set after turn-on of power switch).

Listen status is automatically disabled when MTA (My Talk Address) is received. Listen status is otherwise disabled by IFC (Interface Clear) signal or ULA (Unlisten Address) signal.

3-70. Service Request Capability: SR1.

The 4262A sends an SRQ (Service Request) signal whenever it is set in one of the six possible RQS (Request Status) states. It does this by responding to a serial poll of the controller by setting an STB (Staus Byte) signal on the bus. The 7th bit of this 8 bit signal establishes whether or not a service request exists. The remainder of the 8-bit signal identifies the character of the SRQ.



SRQ (Service Request) is disabled when RQS (Request Status) or STB (Status Byte) is set to 00000000 or when STB (Status Byte) signal transfer is completed.

Request Statuses (RQS) of the 4262A:

(1) DRDY (Data ReaDY): When the 4262A completes a measurement cycle, this status bit is set. This status is set without serial polling if NOT DATA READY is set.
(2) SYN ERR (SYNtax ERRor): When the 4262A receives an erroneous Remote Program Code which is not listed in Table 3-60, this status bit is set.
(3) PASS (Self Test Pass): When PASS is displayed in Self Test done by remote control, this status bit is set.
(4) FAIL 1 (Self Test Fail 1): When FAIL 1 is displayed in Self Test done by remote control, this status bit is set.
(5) FAIL 2 (Self Test Fail 2): When FAIL 2 is displayed in Self Test done by remote control, this status bit is set.
(6) FAIL 3 (Self Test Fail 3): When FAIL 3 is displayed in Self Test done by remote control, this status bit is set.

Table 3-60. Remote Program Codes.

	CONTROL			Program Code
Function	L			F 1
	C			F 2
	R/ESR			F 3
Circuit Mode	AUTO			C 1
	PRL			C 2
	SER			C 3
Loss	D			L 1
	Q			L 2
Frequency	120 Hz			H 1
	1 kHz			H 2
	10 kHz			H 3
Trigger	INT			T 1
	EXT			T 2
	HOLD/MANUAL			T 3
Self Test	OFF			S 0
	ON			S 1
△LCR	OFF			M 0
	ON			M 1
Cp Low Level	OFF			P 0
	ON			P 1
*Data Ready RQS Mode	OFF			D 0
	ON			D 1
LCR Range at 1 kHz	(C)	(L)	(R)	
	100 p	100 μ	1000 m	R 1
	1000	1000	10	R 2
	10 n	10 m	100	R 3
	100	100	1000	R 4
	1000	1000	10 k	R 5
	10 μ	10	100 k	R 6
	100	100	1000 k	R 7
	1000	—	10M	R 8
	— AUTO —			R 9
DQ Range	(D)		(Q)	
	—		1000	N 1
	—		100.0	N 2
	10.00		10.00	N 3
	1.000		1.000	N 4
	— AUTO —			N 5

* Data Ready RQS Mode is automatically disabled when Remote Status is changed to Local Status.

Table 3-61. Remote Message Coding.

		CLASS	DIO 8	7	6	5	4	3	2	DIO 1
DCL	device clear	UC	X	0	0	1	0	1	0	0
GET	group execute trigger	AC	X	0	0	0	1	0	0	0
GTL	go to local	AC	X	0	0	0	0	0	0	1
LLO	local lock out	UC	X	0	0	1	0	0	0	1
MLA	my listen address	AD	X	0	1	L5	L4	L3	L2	L1
MTA	my talk address	AD	X	1	0	T5	T4	T3	T2	T1
OTA	other talk address	AD	(OTA = TAG ∩ $\overline{\text{MTA}}$)							
SDC	selected device clear	AC	X	0	0	0	0	1	0	0
SPD	serial poll disable	UC	X	0	0	1	1	0	0	1
SPE	serial poll enable	UC	X	0	0	1	1	0	0	0
STB	status byte	ST	S	X	S	S	S	S	S	S
UNL	unlisten	AD	X	0	1	1	1	1	1	1
UNT	untalk	AD	X	1	0	1	1	1	1	1

CLASS
UC : Universal Command
AC : Addressed Command
AD : Address
ST : Status Byte

3-71. Remote/Local Capability: RL1.

The 4262A goes to Remote Status only when it accepts Listen address with REN (Remote Enable) line in the Bus lines set to "1". Remote status is not obtained if REN line is set to "1" after Listen address is received. Remote status is returned to Local status when one of following conditions is present:

(1) REN line is set to "0".
(2) LOCAL switch on front panel is depressed.
(3) GTL (Go To Local) command is received.

Local Lock Out: LLO

Local Lock Out inhibits the function of LOCAL switch. This LLO command is a universal command and is valid when REN line is set to "1". LLO command is disabled when REN line is set to "0"

3-72. Device Clear Capability: DC1.

The 4262A is set to initial conditions (the same conditions that are automatically set after turn-on of power switch), when it accepts DCL (Device CLear) command—universal command—or SDC (Selected Device Clear)—addressed command.

3-73. Device Trigger Capability: DT1.

The 4262A is triggered regardless of TRIGGER switch setting when it accepts GET command—address command.

3-74. ADDRESS Switch: ADDRESS switch on the rear panel sets Listen/Talk address. Five section or five bit switch provides 30 settings from 00000 to 11110.

A5	A4	A3	A2	A1		
0	0	0	0	0	.....	0
		(				(
1	1	1	1	0	.....	30

3-75. Remote Message Coding: Interface Bus Command signals for the 4262A are listed in Table 3-61.